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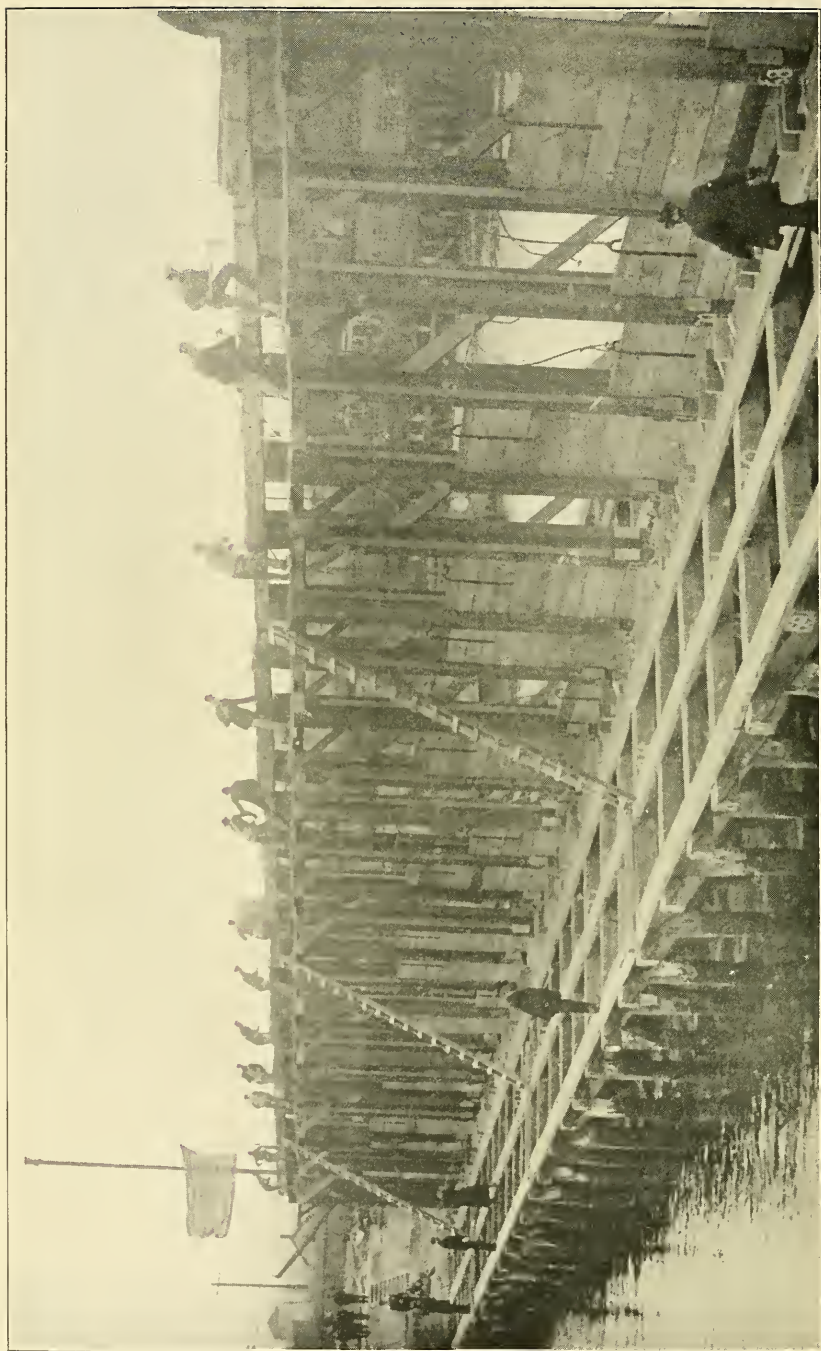
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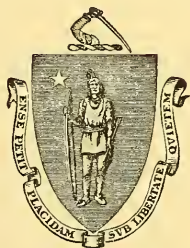
DAM — SHUT-OFF DAM. DROPPING GATES.

SIXTH ANNUAL REPORT

OF THE

CHARLES RIVER BASIN
COMMISSION.

DECEMBER 1, 1908.



BOSTON:

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The Commonwealth of Massachusetts.

SIXTH REPORT OF THE CHARLES RIVER BASIN COMMISSION.

*To His Excellency the Governor and the Honorable Council of the
Commonwealth of Massachusetts.*

The Commission appointed under chapter 465 of the Acts of 1903, known as the Charles River Basin Commission, has the honor to make the following report of its proceedings for the fiscal year ending Nov. 30, 1908. As required by law, the Commission filed, on Jan. 20, 1909, with the Secretary of the Commonwealth, the statement printed herewith of its expenditures and receipts. The Commission also filed an abstract of its doings for the fiscal year. It has required all the energies of the engineering force to push the construction work as rapidly as the Commission deemed necessary, so that this longer narrative describing the work in detail has been somewhat delayed. As a result of dividing the work into numerous contracts, and requiring prompt performance of the same, the Commission is able to report that in less than four years after the letting of the first contract the public were given the Basin to use and to enjoy.

I. THE RIVER CLOSED BY THE SHUT-OFF DAM.

On Oct. 20, 1908, the eighty-two gates in the shut-off dam, described in the Commission's last report, were closed simultaneously. The wooden framework into which the gates were dropped and wedged held firmly, in spite of the enormous pressure to which it was subjected by the water before the earth fill which gives it support was put in place. By the

building of the structures on the Boston and Cambridge sides of the shut-off dam, and the lower portion of that structure itself, the river had been greatly narrowed. This, of course, increased the velocity of the currents to something never known before in Charles River. The water ran through the structure of the Lock as in a mill race, and it was necessary to employ the powerful towboat "Edwin L. Pilsbury" to assist other tugs in getting their tows through the Lock. There was only one disappointing feature: the Basin in the beginning had to be filled for the most part with salt water, the long drought having reduced the daily flow of the Charles River to so small an amount that to fill it with fresh water would have taken many days, whereas it was possible to fill the Basin in a few hours with water let in through the sluices. The permanent water level, established soon after the closing of the shut-off, is at the grade of 8 feet above Boston Base, and Boston Base is 0.64 of a foot below mean low-water mark.

Prior to the operation of the shut-off the ship Lock had been completed and thoroughly tested. This Lock is 350 feet long, 45 feet wide, and deep enough to admit at low tide any vessel which can navigate the channels of the Basin. The channels in the lower Basin, having a depth of 18 feet, as well as the channels in Broad and Lechmere canals, have been dredged to the depth required by law.

The larger gate, which is at the lower or Harbor end of the Lock, deserves more than passing notice. It has some mechanical features unlike any which have ever before been applied to lock-gates. The mechanical adjustments necessary to operate this structure, as well as the smaller gate of the same type which does duty at the upper end of the Lock, have been a complete success.

The nine sluices were also completed before the closing of the shut-off dam. These serve the purpose of carrying off the flood water of Charles River and generally of regulating the height of the water in the Basin. The middle and largest sluice serves the additional purpose (when not used for sluicing) of a lock whereby small boats, such as rowboats, power boats and others not requiring much headroom are allowed to pass under the Dam.

All the offensive mud flats between Craigie Bridge and Watertown Dam have been effectually hidden from sight and smell. Seventeen and one-half miles of shore line have undergone a transformation which will render their further improvement a matter of small expense compared to the cost of their treatment, either by walls or by gravel beach, when the tidal currents and the condition of low tide had to be contended with.

Although not required to do so by the statute, the Commission deemed it wise to make special efforts to complete and operate, before the closing of the shut-off dam, the Boston and Cambridge marginal conduits, which structures are intended to intercept the sewer overflows into the Basin. The Cambridge Marginal Conduit was ready for use at the time of the closing and the Boston Marginal Conduit was ready shortly thereafter.

II. THE PROBABLE TIME OF COMPLETING THE PERMANENT DAM IS JULY 1, 1910.

The Commission, having assigned to it by law no duty except to plan and complete certain construction work, has from the outset made every effort to complete that work so that the public might get the full benefit of the improvements in Charles River at the earliest possible date. The salt marshes of Cambridge, Brighton, Watertown and Newton, and much of the other territory bordering on Charles River Basin, have remained practically undeveloped for centuries. The Charles River Dam, bearing, as it does, the most important relation to any work connected with the improvement of the river banks, the reclaiming of the marshes and other developments, has seemed to require haste in its construction beyond that usually required in public work. Even with the completion of this Commission's work the proper utilization of the Basin and the Charles River above it may be said to be just at its beginning. The problem of how to use the new Basin to obtain from it the greatest benefits to the public, especially in the treatment of the shores and in relation to the upper reaches of the river above Watertown Dam, is no less worthy of study than was the question of the feasibility and desirability of the

Dam itself. At the close of the fiscal year covered by this report, the Commission, after going over the work being done under its contracts then existing, and after carefully considering the contracts in preparation, was able to predict that it would finish substantially all of its work by July 1, 1910, and so reported to the Governor and Council.

The total amount of the Commission's expenditures during the year was \$1,086,011.31, the items of which will appear in the financial report previously submitted and printed herewith.

III. ORGANIZATION AND ADMINISTRATION.

(a) *The Commission, Officers and Employees.*

On Jan. 1, 1908, the Commission lost its first Chairman, Dr. Henry S. Pritchett, who resigned to become the head of the Carnegie Foundation in New York. His large experience in construction work for the United States Government and as the head of the Massachusetts Institute of Technology had been most helpful in organizing and planning the Commission's work. During his two years' work as Chairman of the Committee on Charles River Dam, upon whose decision the Charles River Basin Act was predicated, investigating the sanitary and other questions connected with the proposed Dam and helping to produce the Committee's excellent report, much prized by hydraulic engineers and sanitary experts throughout the world, Dr. Pritchett was able to become familiar with the most important problems which confronted the Commission, to whom was assigned the task of building the Dam. This knowledge, combined with his sound judgment, was felt from the outset in the selection of the Commission's engineers and in laying out the work to secure rapid and effective construction at low cost.

It is but a slight acknowledgment of Dr. Pritchett's services to say that the Metropolitan District will always be indebted to him for the energy and thought which for nearly six years he gave to the improvement of the Charles River Basin.

The Hon. Henry D. Yerxa was appointed to succeed Dr. Pritchett as Chairman, and the Hon. Edgar R. Champlin was appointed to fill the vacancy in the Commission. William S.

Youngman continued as Secretary, and Hiram A. Miller as Chief Engineer.

No change was made in the administrative office force. Many promotions and changes occurred in the engineering force, and these will be found described in the report of the Chief Engineer, appended hereto. Several of the younger engineers, who gained valuable experience in designing and building the various features of the Charles River Dam, were called to new and larger work, such as the Panama Canal, the reconstructed Erie Canal and the dams, reservoirs and aqueducts being constructed under the New York Board of Water Supply.

(b) *Offices and Buildings.*

The office of the Charles River Basin Commission is located on the sixth floor of the Standish Building, No. 367 Boylston Street. The principal field office is at No. 12 Bridge Street, East Cambridge. The center of much of the Commission's mechanical work is in the steel shed at the corner of Charles and Leverett streets, Boston. The field office for the Boston Embankment work had to be transferred on account of the sale of the property occupied at No. 108 Chestnut Street.

IV. THE DAM AND LOCKS.

(a) *The Shut-off Dam in Relation to the Permanent Dam.*

It is obvious that the permanent Dam, which is to be an earthwork structure with retaining walls, could not be put in while there were strong tidal currents to contend with twice daily. These currents would have rendered an earth dam impossible. The temporary dam, called the "shut-off dam," was therefore designed and has proved effective. A detailed description of this very interesting structure will be found in the Chief Engineer's report.

The Basin wall of the Dam, with the exception of a gap east of the flood sluices on the Cambridge side, and a small portion of the Harbor wall were completed before the close of the year.

(b) *The Locks.*

The ship Lock, with all its gates, valves and other appliances, was in full operation and working smoothly. The mechanisms for handling the same, as well as for handling the drawbridge, were controlled from a temporary operating tower, the permanent building, known as the "lower lock-gate house," being still in process of construction.

The rest pier, for the accommodation of vessels approaching the Lock, had been completed.

During all the operation of closing the shut-off dam, navigation was maintained through the Lock without special delay.

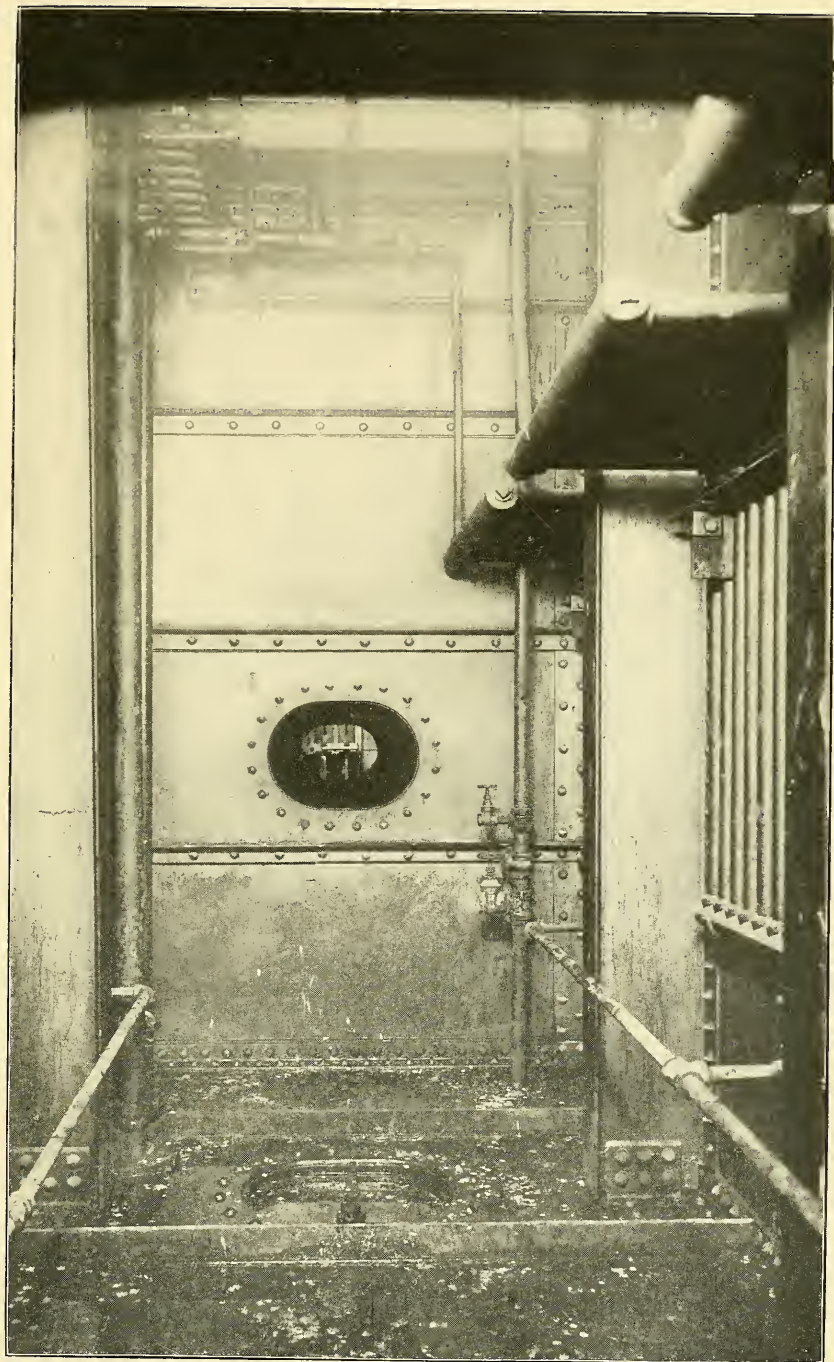
The small boat lock at the Cambridge end of the Dam was completed before the close of the year.

(c) *The Lock-gates.*

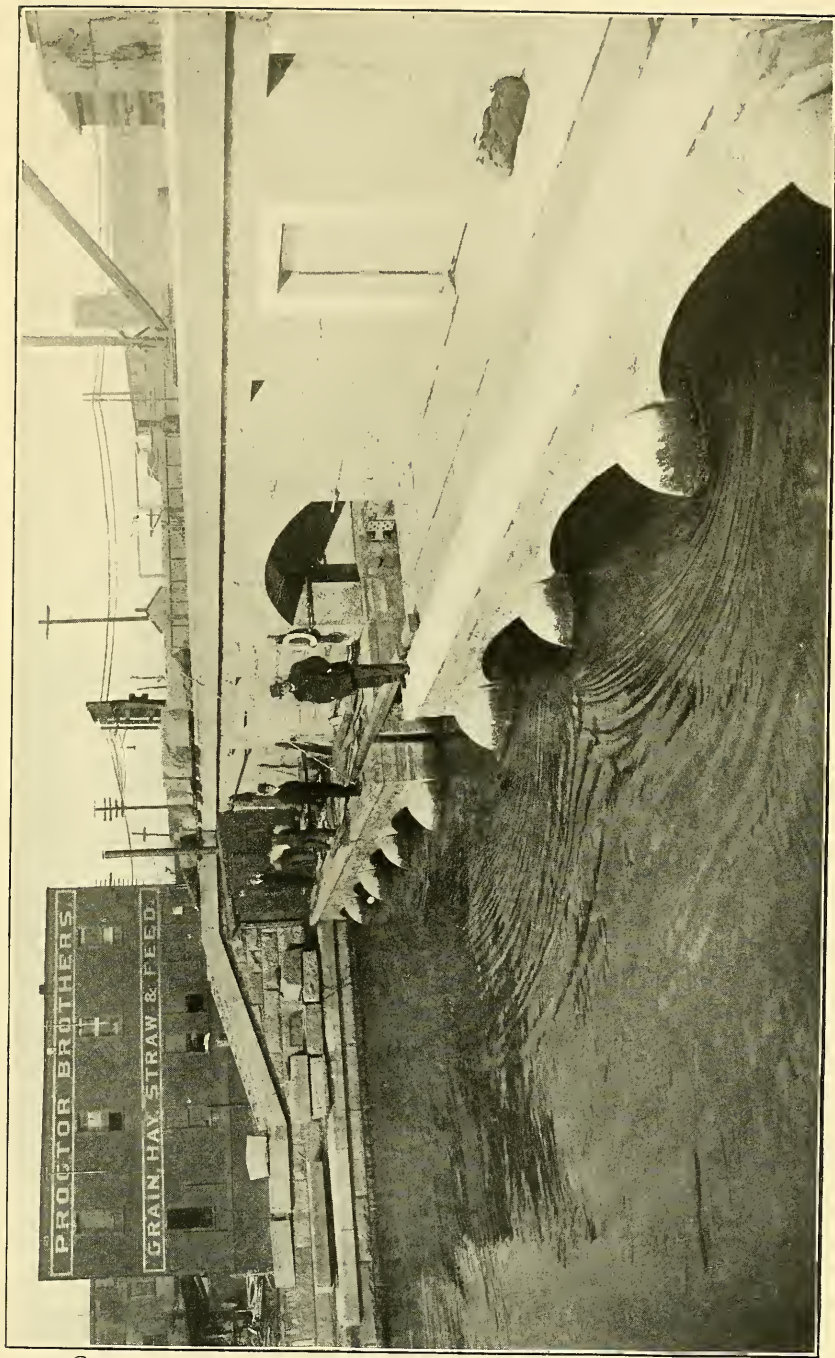
The lock-gates of the main Lock constitute one of the most interesting and unique engineering features connected with the Dam. They are built of steel, of the caisson type, each gate moving along its own longitudinal axis into a recess in the Lock wall. They are equipped so as to be able to take pressures in both directions and are steam heated so that they can be operated in winter. They are also equipped with compressed air apparatus, so that the lower part of the gate may be used practically as a diving bell, even while the gate is in motion. A very complete and detailed description of these gates will be found in the Chief Engineer's report.

(d) *The Lock-gate Houses.*

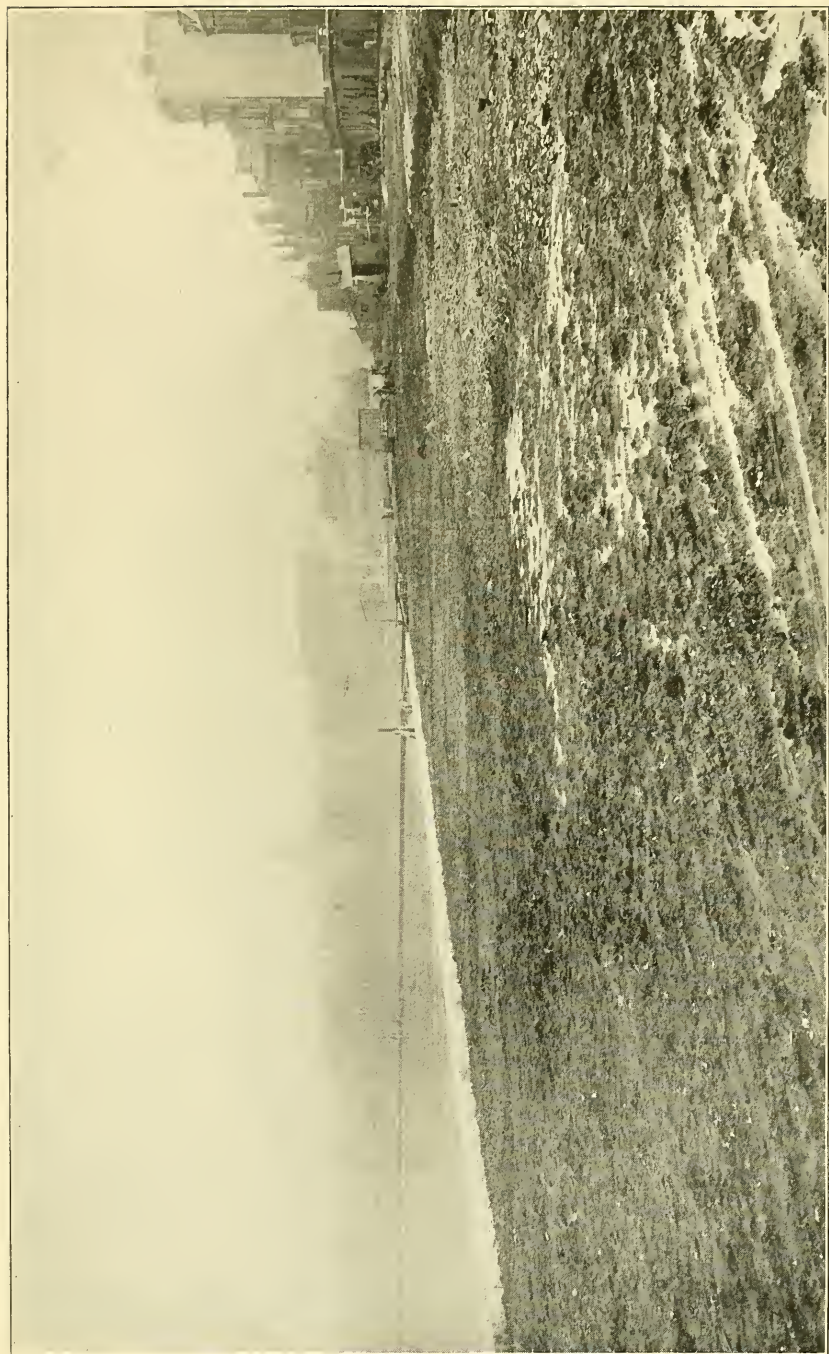
Over the recess into which each of the lock-gates rolls has been built a gate-house, and in connection with the lower lock-gate house is built an operating tower, from which the electrical engineer in charge controls all the mechanisms, not only of the lock-gates and the filling gates for raising and lowering the water in the Lock, but the double drawbridge as well.



LOCK—INTERIOR OF LOWER GATE. HEATING APPARATUS.



SLUICES—SIX GATES HALF OPEN.



BOSTON EMBANKMENT — LOOKING DOWN-STREAM FROM BERKELEY STREET.

V. THE SLUICES.

Before the completion of the shut-off dam the Cambridge coffer-dam was removed so as to allow free passage of water through the flood sluices. The sluice-gates, under construction by the Coffin Valve Company, and the controlling devices were completed early in August.

The nine sluices have been found to be capable of making all the changes which so far have been necessary in the level of the Basin, either in letting out the flow of Charles River or in letting in salt water to fill up the Basin.

VI. THE BOSTON EMBANKMENT.

The Boston Embankment, which extends from Cambridge Bridge to Charlesgate West, gave evidence of some quick work done during the year by the contractors on the various sections: the Holbrook, Cabot & Rollins Corporation, Coleman Brothers, and William H. Ellis, respectively. The wall was finished and much of the filling had been put in on the wide part of the embankment back of Charles and Brimmer streets, where it ranges in width from a maximum of 300 feet to 240 feet. In the long stretch where the embankment runs parallel to Beacon Street, from Berkeley Street to Charlesgate West, it is 100 feet wide, and there also a large part of the filling had been done.

VII. DELAY AND CHANGES IN THE COMMISSION'S WORK DUE TO THE RIVERBANK SUBWAY ACT OF 1907.

In its last report the Commission called attention to the fact that it had complied with certain requests for delay and changes in its plans for the Boston Embankment, which the Boston Transit Commission, by section 2 of chapter 573 of the Acts of 1907, was authorized to make in order to accommodate the Riverbank subway. The Commission, having been notified by the Boston Transit Commission that the Boston Elevated Railway Company was not willing to set any definite date for the beginning of the construction of the Riverbank subway, decided to proceed with the work of filling the Boston Embankment

between the Boston Marginal Conduit and the wall of Back Street. In order properly to protect the marginal conduit and the sewer overflow conduits from frost, it was necessary to put in considerable filling. The quantity of filling which could safely have been omitted was, therefore, very small, and in view of the possibility that a part of the embankment might be left as an open ditch which would be offensive for several years, the Commission decided to complete the filling and make the surface attractive.

The Commission was of the opinion, based on the estimates of its engineers, that the additional cost of the subway, due to the removal of earth fill beyond what was required for covering the conduits, would be small, considering the disadvantages of leaving unfinished for an indefinite period an embankment which had already cost the public upwards of \$480,000.

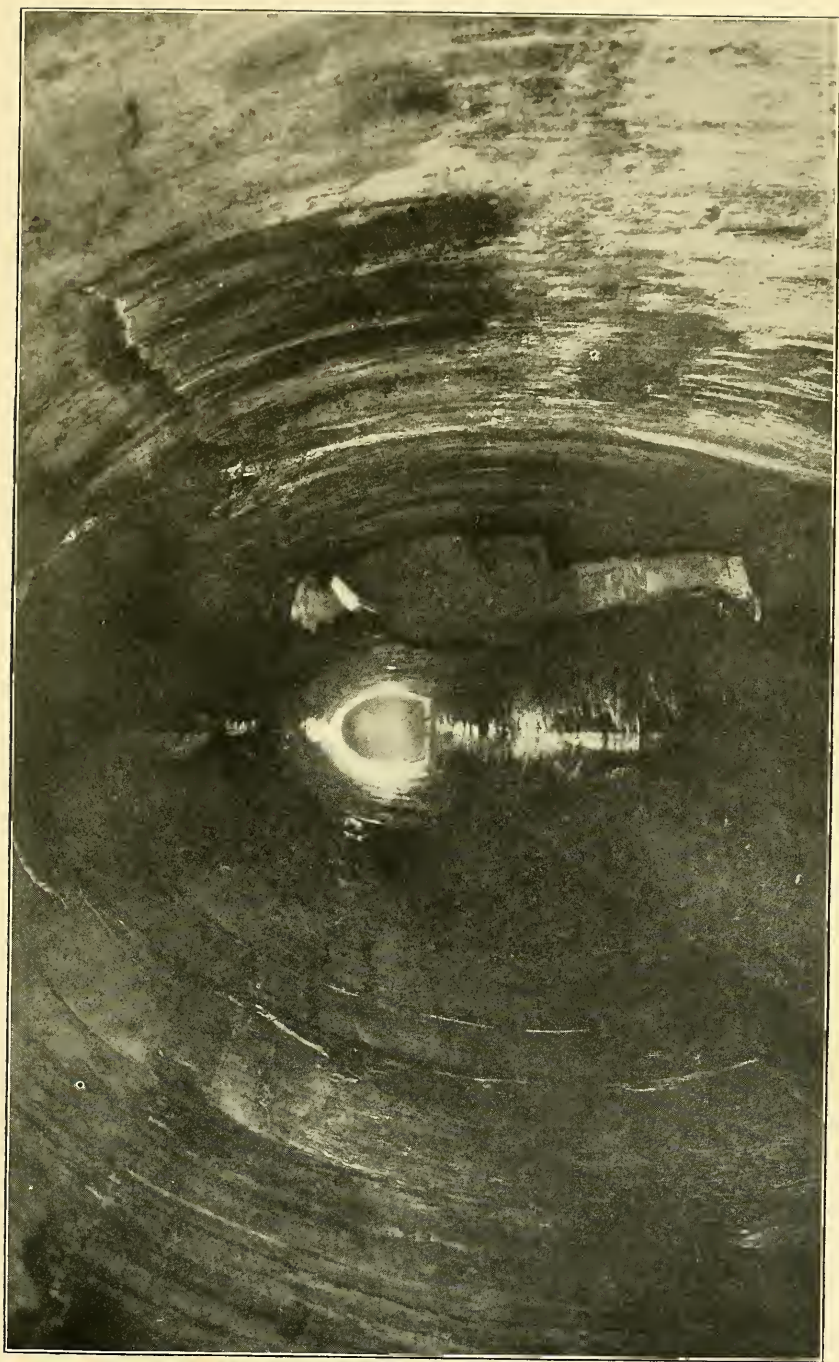
VIII. THE CRAIGIE TEMPORARY BRIDGE.

The temporary bridge, just below the site of the new Dam, has been maintained by the Commission as heretofore, and the heavy traffic usually found at that point has passed over it daily without experiencing any delay due to the condition of the bridge. Monthly inspections were made of piles and timbers beneath the bridge, and the necessary repairs were promptly attended to.

IX. THE MARGINAL CONDUITS.

Work upon the Boston Marginal Conduit which, in addition to other functions, is to take the foul flow from the Stony Brook channels and carry it below the Dam, and which extends from Charlesgate East to the foot of Leverett Street, a distance of nearly two miles, has progressed favorably. The smaller conduits, known as "overflows," through which the sewers in the Back Bay formerly discharged their contents into the river in time of storm, have been connected with the Boston Marginal Conduit.

The Cambridge Marginal Conduit has been completed. It is not required to take care of any such condition as that created by Stony Brook, but it will serve the same purpose on the Cambridge side, for intercepting overflows of sewage, that the



BOSTON MARGINAL CONDUIT — INTERIOR VIEW.

longer conduit in Boston serves. The work of carrying the Cambridge Marginal Conduit under the Lechmere Canal by means of an inverted siphon was successfully accomplished, under the direction of the Commission's engineers, by the contractor, Mr. Hiram W. Phillips of Quincy, Mass.

X. DREDGING AND PILE-DRIVING AT THE WHARVES IN BROAD AND LECHMERE CANALS.

The pile-driving work at the wharves in Broad and Lechmere canals, except in front of one property where the line is not yet established, was finished during the year. Nearly all of the dredging required by the Charles River Basin Act, and specified as follows, has been done:—

Broad Canal, to a depth of 17 feet to the Third Street draw, 13 feet to the Sixth Street draw, 11 feet to the railroad draw, and 9 feet from the railroad draw to the end of the canal.

Lechmere Canal, to a depth of 17 feet up to and including Sawyer's lumber wharf, and 13 feet from Sawyer's wharf to the head of the canal at Bent Street.

Thus, at the close of the fiscal year, most of the wharf owners are enjoying substantially all the benefits they will have when the permanent Dam is completed.

XI. LEGISLATION OF 1908.

The Commission's only recommendation for legislation in 1908 was considered favorably by the Legislature, and resulted in the passage of chapter 445 of the Acts of 1908, which authorized the Commission to take a portion of the land of the Massachusetts Charitable Eye and Ear Infirmary to provide an approach to the Boston Embankment, which, owing to an omission in the Boston Embankment Act (chapter 402 of the Acts of 1906), had been left without an entrance at its lower end.

XII. WORK ORDERED BY THE LEGISLATURE IN CHAPTER 633 OF THE ACTS OF 1908, ON THE PROPERTY OF THE BAY STATE FUEL COMPANY.

The Commission promptly performed the work which the Legislature directed it to do by chapter 633 of the Acts of 1908, in rebuilding the sea-wall on the property leased by the Bay

State Fuel Company on Broad Canal in Cambridge. The work was substantially completed before the shut-off dam raised the permanent water level, at a net expense to the Metropolitan District of \$12,120.80.

XIII. JOINT ACTION WITH THE METROPOLITAN PARK COMMISSION RELATIVE TO GRANTING OF LOCATIONS FOR BOAT-HOUSES ON THE BOSTON EMBANKMENT, UNDER CHAPTER 404 OF THE ACTS OF 1907.

As required by law, the Commission sat jointly with the Metropolitan Park Commission to consider applications by regularly organized boat clubs for locations for boat-houses on the Boston Embankment. A location was granted to the Union Boat Club of Boston.

XIV. TAKINGS OF PROPERTY.

Under authority of chapter 445 of the Acts of 1908, the Commission made a taking of a part of the property of the Massachusetts Charitable Eye and Ear Infirmary, and paid for the same the price which the officials of the Infirmary had agreed to, and which the Commission stated in its recommendation to the Legislature.

XV. LITIGATION.

Before paying the Massachusetts Charitable Eye and Ear Infirmary for the property purchased from them under authority of chapter 445 of the Acts of 1908, the Commission secured releases of the Commonwealth from damages on account of two other takings made by it, affecting the same corporation's property.

A settlement was made with Mr. George O. Proctor for land taken for an approach to the Dam and other purposes, in East Cambridge.

A settlement was made with Mr. Isaac Cohen, petitioner for damages on account of the taking of leasehold rights on the Proctor property.

XVI. CONTRACTS.

(a) List of Contracts.

A list of the contracts awarded and pending during the year will be found in Appendix B. The contracts are discussed in the Chief Engineer's report, hereto annexed.

(b) Sums held back from Contractors.

The amounts reserved from sums due all contractors on monthly estimates, and not payable until after the completion of the contracts or until final settlement, are as follows: —

No. of Contract.	Contractor.	Work.	Amount.
1	Holbrook, Cabot & Rollins Corporation.	Dam and Lock in the Charles River.	\$40,000 00
30	New Jersey-West Virginia Bridge Company.	Lock-gates,	2,037 57
44	Coleman Brothers,	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	35,462 89
50	Holbrook, Cabot & Rollins Corporation.	Sections 4 and 5 of the Boston Marginal Conduit and Sections 2 and 3 of the Boston Embankment.	50,144 02
66	The Cutler-Hammer Manufacturing Company.	Controlling devices for operating motors of main lock-gates.	443 70
81	William H. Ellis,	Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment.	10,272 17
94	Horton & Hemenway,	Lower lock-gate house,	3,959 67
95	Hiram W. Phillips,	Submerged outlets for the Boston Marginal Conduit.	3,825 00
97	The Merrill Company,	Piping at Lock,	329 35
98	Barnes-Pope Electric Company, .	Electric wiring for lock-gate houses,	50 33
100	The Norcross Brothers Company,	Upper lock-gate house,	702 00
101	Buerkel & Company,	Plumbing for lower lock-gate house,	145 05
105	Coleman Brothers,	Part of the Cambridge Marginal Conduit.	1,013 25
106	William L. Miller,	Wall at wharf of Bay State Fuel Company, on Broad Canal.	2,656 88
			\$151,041 88

XVII. HEARINGS, MEETINGS AND CONFERENCES.

The Commission gave, during the year, twenty-four hearings, at which a total of forty-three persons were heard, besides holding one hundred four formal meetings and many conferences.

XVIII. ISSUE OF BONDS.

On Feb. 3, 1908, the Commission advised the Treasurer of the Commonwealth that it would need \$1,200,000 for its work for the ensuing year. Bonds to the amount of \$400,000 were

issued and sold under the title of the "Charles River Basin Loan," there having been an unexpended balance at the close of the fiscal year ending Nov. 30, 1907, of \$764,816.11. The total issue of bonds on account of the Charles River Basin Loan to Dec. 1, 1908, was \$2,800,000.

XIX. PAYMENTS TO THE SINKING FUND.

Payments to the sinking fund of the Charles River Basin Loan during the year amounted to \$32,532.81. The total payments to the sinking fund to Dec. 1, 1908, were \$139,530.24.

XX. REPORTS ISSUED BY THE COMMISSION.

Fifteen hundred reports were printed, at a cost of \$483.33, making the reports cost less than 30 cents each for unbound copies. Of this number the Commission was allowed for distribution, to meet the demands of officials and citizens of the thirty-eight cities and towns which are to pay for its work, only 450 copies. Many requests for reports, even from public officials, had to be denied. Now that the public is able to observe the effect on the river and the river banks of the Charles River Basin work, the demand for the current number of the report is increasing. The Commission believes that more copies of its next annual report should be authorized and that additional copies of its previous reports should be printed.

XXI. STATEMENT OF EXPENDITURES AND RECEIPTS.

The following statement of expenditures and receipts was filed on Jan. 20, 1909: —

The total amount of expenditures from Dec. 1, 1907, to Nov. 30, 1908, was \$1,086,011.31. The total amount from July 29, 1903, the date when the Commission was organized, to Nov. 30, 1908, was \$2,721,195.20, and the total amount of receipts between the same dates was \$2,563.71.

The general character of these expenditures and receipts is shown in the following tables: —

Expenditures.

	For the Year Ending Nov. 30, 1908.	From Beginning of Work to Nov. 30, 1908.	
<i>Administration.</i>			
Commissioners,	\$10,000 00	\$53,024 69	
Secretary,	3,000 00	11,483 33	
Clerks and stenographers,	1,669 29	5,177 44	
Legal services,	—	18 00	
Traveling,	130 53	902 41	
Stationery and printing,	273 05	2,881 87	
Postage, express and telegrams,	47 69	241 54	
Furniture and fixtures,	214 63	693 64	
Alterations and repairs of building,	1 25	124 35	
Telephone and lighting,	366 94	909 59	
Rent,	426 02	1,765 32	
Miscellaneous expenses,	104 26	502 91	
	\$16,233 66		\$77,725 09
<i>Engineering.</i>			
Chief, principal assistant and division engineers,	\$16,275 38	\$63,696 11	
Engineering assistants,	46,449 84	149,264 50	
Consulting engineers,	4,548 15	15,349 25	
Inspectors,	33,053 38	79,942 08	
Architect,	482 86	3,467 74	
Traveling,	694 29	2,130 40	
Wagon hire,	62 00	141 75	
Stationery and printing,	1,674 93	5,739 89	
Postage, express and telegrams,	80 35	292 69	
Instruments, tools and boats,	1,214 82	8,549 85	
Engineering and drafting supplies,	745 72	2,634 81	
Books, maps and photographs,	1,086 55	3,698 44	
Furniture and fixtures,	701 83	3,833 72	
Alterations and repairs of buildings:—			
Main office,	1 25	1,109 39	
Sub-offices,	402 73	859 02	
Telephone and lighting, main office,	447 31	1,353 17	
Telephone, lighting, heating, water and care of building, sub-offices,	664 47	1,864 58	
Rent, main office,	1,865 72	9,026 55	
Rent of field offices,	135 00	566 45	
Unclassified supplies,	709 81	1,550 64	
Miscellaneous expenses,	192 44	531 73	
	111,488 83		355,602 76
<i>Construction — Preliminary.</i>			
Advertising,	\$559 94	\$1,592 60	
Labor,	57 75	6,109 09	
Professional services,	—	8 40	
Traveling,	—	19 08	
Water rates,	—	3 45	
Freight and express,	—	67 42	
Jobbing and repairing,	—	35 68	
Tools, machinery, appliances and hardware supplies,	4 10	220 26	
Castings, ironwork and metals,	—	222 09	
Iron pipe and valves,	—	98 96	
Fuel, oil and waste,	—	65 05	
Lumber,	—	367 15	
Cement,	—	24 75	
Sand,	—	3 00	
Unclassified supplies,	35 00	73 19	
Miscellaneous expenses,	—	488 68	
	656 79		9,398 85
<i>Construction — Contracts.</i>			
Contracts completed and final payments made prior to Dec. 1, 1907,	—	\$175,789 97	
Contract No. 1, Holbrook, Cabot & Rollins Corporation,	\$194,257 49	736,236 02	
Contract No. 5, Henry R. Worthington,	1,700 00	9,326 40	
Contract No. 19, The Scherzer Rolling Lift Bridge Co.,	1,000 00	4,500 00	
Contract No. 23, Holbrook, Cabot & Rollins Corporation,	13,510 80	82,063 73	
Contract No. 24, American Bridge Co. of New York,	11,064 42	40,814 42	
Contract No. 25, Coffin Valve Co.,	5,180 00	21,080 00	
Contract No. 27, Coffin Valve Co.,	9,946 20	14,303 70	
	\$230,658 91	\$128,379 28	\$1,084,114 24
<i>Amounts carried forward,</i>			\$442,726 70

Expenditures — Continued.

	For the Year Ending Nov. 30, 1908.		From Beginning of Work to Nov. 30, 1908.	
<i>Amounts brought forward,</i>	\$236,658 91	\$128,379 28	\$1,084,114 24	\$442,726 70
<i>Construction — Contracts — Con.</i>				
Contract No. 28, Coffin Valve Co.,	665 70		4,438 00	
Contract No. 30, New Jersey-West Virginia Bridge Co.,	9,829 98		25,129 98	
Contract No. 34, Geo. McQuesten Co.,	778 84		832 99	
Contract No. 37, American Ship Windlass Co.,	635 00		2,210 00	
Contract No. 41, Coffin Valve Co.,	3,148 95		9,904 20	
Contract No. 44, Coleman Bros.,	113,127 54		280,956 38	
Contract No. 48, The Lumsden & Van Stone Co.,	-		629 40	
Contract No. 50, Holbrook, Cabot & Rollins Corporation,	214,083 37		284,149 46	
Contract No. 51, Lynch & Woodward,	-		541 00	
Contract No. 57, Wm. H. Wood & Co.,	738 98		3,501 68	
Contract No. 59, The Lockwood Manufacturing Co.,	415 03		847 00	
Contract No. 60, Link-Belt Co.,	10,030 05		10,030 05	
Contract No. 63, Baltimore Bridge Co.,	771 45		5,143 00	
Contract No. 66, The Cutler-Hammer Manufacturing Co.,	2,514 30		2,514 30	
Contract No. 69, Camden Iron Works,	592 89		4,761 25	
Contract No. 70, Patrick McGovern,	45,232 31		47,508 22	
Contract No. 71, Dodd & McLaughlin,	1,424 48		1,424 48	
Contract No. 72, American Luxfer Prism Co. of Illinois,	1,350 00		1,350 00	
Contract No. 74, The Lawrence Machine Co.,	493 20		493 20	
Contract No. 75, Westinghouse Traction Brake Co.,	1,393 20		1,393 20	
Contract No. 76, Hiram W. Phillips,	14,775 93		15,515 43	
Contract No. 78, The Lockwood Manufacturing Co.,	1,673 00		1,673 00	
Contract No. 79, H. P. Converse & Co.,	470 00		470 00	
Contract No. 80, The Lockwood Manufacturing Co.,	227 00		227 00	
Contract No. 81, William H. Ellis,	58,208 93		58,208 93	
Contract No. 84, Camden Iron Works,	1,580 76		1,580 76	
Contract No. 85, Coldwell-Wilcox Co.,	238 00		238 00	
Contract No. 86, Aberthaw Construction Co.,	1,051 43		1,051 43	
Contract No. 87, Barbour Stockwell Co.,	245 92		245 92	
Contract No. 88, New England Bolt & Steel Co.,	558 50		558 50	
Contract No. 89, Wm. H. Wood & Co.,	3,029 98		3,029 98	
Contract No. 90, Gibby Foundry Co.,	3,000 00		3,000 00	
Contract No. 91, William L. Miller,	1,008 77		1,008 77	
Contract No. 92, The Phoenix Iron Co.,	4,570 00		4,570 00	
Contract No. 93, James W. Sederquist,	1,006 71		1,006 71	
Contract No. 94, Horton & Hemenway,	22,438 14		22,438 14	
Contract No. 95, Hiram W. Phillips,	21,675 00		21,675 00	
Contract No. 97, The Merrill Co.,	1,866 29		1,866 29	
Contract No. 98, Barnes-Pope Electric Co.,	285 17		285 17	
Contract No. 99, American Bridge Co. of New York,	1,475 00		1,475 00	
Contract No. 100, The Norcross Brothers Co.,	3,978 00		3,978 00	
Contract No. 101, Buerkel & Co.,	821 98		821 98	
Contract No. 105, Coleman Bros.,	5,741 75		5,741 75	
Contract No. 106, William L. Miller,	15,055 62		15,055 62	
		808,866 06		1,937,593 41
<i>Construction — Additional.</i>				
Advertising,	-		\$2 00	
Labor,	\$42,545 51		102,388 61	
Professional services,	-		208 00	
Traveling,	71		2 12	
Water rates,	35 00		35 00	
Freight and express,	334 71		699 40	
Jobbing and repairing,	658 60		1,549 28	
Tools, machinery, appliances and hardware supplies,	7,492 71		15,156 86	
Castings, ironwork and metals,	3,891 07		8,393 59	
<i>Amounts carried forward,</i>	\$54,958 31	\$937,245 34	\$128,434 86	\$2,380,320 11

Expenditures — Concluded.

	For the Year Ending Nov. 30, 1908.		From Beginning of Work to Nov. 30, 1908.	
<i>Amounts brought forward,</i>	\$54,958 31	\$937,245 34	\$128,434 86	\$2,380,320 11
<i>Construction — Additional — Con.</i>				
Iron pipe and valves,	2,038 37		4,999 66	
Paint and coating,	835 30		1,528 69	
Fuel, oil and waste,	581 56		1,624 80	
Lumber and field buildings,	2,662 38		8,995 22	
Brick, cement and stone,	22 39		41 44	
Sand and gravel,	47 70		110 35	
Municipal and corporation work,	4,796 19		5,687 79	
Unclassified supplies,	296 87		593 70	
Telephone, lighting and power,	2,413 61		5,536 63	
Miscellaneous expenses,	4,202 68		4,228 33	
		72,855 36		161,781 47
<i>Real Estate.</i>				
Legal and expert,	\$577 70		\$1,128 30	
Care and disposal,	—		146 55	
Settlements,	22,747 35		125,233 21	
Payment relative to betterments to be as- sessed on remainder of land of Massachu- setts Charitable Eye and Ear Infirmary, Purchase,	1,691 40 50,894 16		1,691 40 50,894 16	
		75,910 61		179,093 62
Totals,		\$1,086,011 31		\$2,721,195 20

The foregoing expenditures have been distributed among the various objects or works as follows: —

	For the Year Ending Nov. 30, 1908.	From Beginning of Work to Nov. 30, 1908.
Administration,	\$16,233 66	\$77,725 09
Dam,	200,720 77	558,017 10
Lock,	169,924 66	584,602 85
Temporary bridge and approaches,	23,155 60	156,725 67
Drawbridge,	16,216 99	91,102 50
Highway,	83 00	239 12
Dredging and pile-driving in Basin,	7,774 43	35,340 34
Broad Canal,	28,241 96	99,714 05
Lechmere Canal,	11,509 62	42,105 99
Boston Embankment,	285,061 37	504,268 68
Boston Marginal Conduit,	249,420 98	478,078 20
Cambridge Marginal Conduit,	77,668 27	93,275 61
Totals,	\$1,086,011 31	\$2,721,195 20

Receipts.

	For the Year Ending Nov. 30, 1908.	From Beginning of Work to Nov. 30, 1908.
<i>To the Credit of the Loan Fund.</i>		
Buildings,	—	\$3 00
Labor, tools, supplies and reimbursements,	\$481 22	750 22
<i>To the Credit of the Sinking Fund.</i>		
Rents,	—	1,810 49
Totals,	\$481 22	\$2,563 71

The foregoing receipts have been credited to the various objects or works as follows:—

	For the Year Ending Nov. 30, 1908.	From Beginning of Work to Nov. 30, 1908.
Dam,	—	\$1,816 99
Lock,	\$389 51	438 57
Temporary bridge and approaches,	42 25	143 69
Drawbridge,	—	81 00
Dredging and pile-driving in Basin,	—	2 00
Broad Canal,	—	10 00
Lechmere Canal,	—	7 00
Boston Embankment,	2 10	2 10
Boston Marginal Conduit,	9 25	24 25
Cambridge Marginal Conduit,	38 11	38 11
Totals,	\$481 22	\$2,563 71

The report of the Chief Engineer follows.

In Appendix A will be found chapter 465 of the Acts of 1903 (original Charles River Basin Act) and chapter 65 of the Acts of 1905 and chapters 368 and 402 of the Acts of 1906, which amend the same; also chapter 107 of the Resolves of 1904, chapter 158 of the Acts of 1906, chapter 404 of the Acts of 1907, and chapters 445 and 633 of the Acts of 1908.

Respectfully submitted,

HENRY D. YERXA,
JOSHUA B. HOLDEN,
EDGAR R. CHAMPLIN,

Charles River Basin Commission.

BOSTON, Nov. 30, 1909.

REPORT OF THE CHIEF ENGINEER.

To the Charles River Basin Commission.

GENTLEMEN:— The following is a report of the work of the engineering department for the year ending Nov. 30, 1908.

ORGANIZATION.

Mr. John L. Howard continued in charge of field work, as principal assistant engineer.

Mr. Edward C. Sherman, division engineer, continued in charge of designing, drafting and other office work.

Mr. Frederic P. Stearns continued to act as consulting engineer.

Mr. Guy Lowell continued to act as consulting architect and landscape architect.

The engineering force at the beginning of the year numbered 77, and was increased from time to time as the work required, until August 29, when it numbered 100. At the end of the year it numbered 82.

The names of the assistants in the engineering department, not mentioned above, who have been employed for not less than one month are given below, with the positions last held, together with an indication of the work performed by them:—

Division Engineers.

- | | |
|-------------------------|--|
| John N. Ferguson, . . . | In charge of the construction of the Boston Embankment and the Boston Marginal Conduit, including the Fens gate-chamber; also in charge of measurements of the flow of the river at Waltham and of the inspection of the sewer overflows into the Basin below the Cottage Farm bridge. |
| J. Albert Holmes, . . . | In charge of the work at the Dam and Lock, the Cambridge Marginal Conduit, and the dredging in the Cambridge canals and Basin. |

Mechanical Engineer.

- Walton H. Sears, . . . Design and erection of sluice-gates and operating machinery, lubricating system for the lock-gates, steam piping at the Lock and sluices, compressed air system, and lock-gate operating machinery; making tests of tightness of lock-gates and capacity of pumps; and miscellaneous mechanical engineering.

Electrical Engineer.

- Arthur I. Plaisted, . . . Electrical design and construction; the erection of metal work at the Dam and Lock; and the operation of the Lock, drawbridge and flood sluices.

Assistant Engineers.

- Walter R. Kattelle, . . . Design and supervision of construction of the lock-gate houses at the Dam; studies for the Fens gate-house; and miscellaneous office work.
- Morton F. Sanborn, . . . In charge of work on the Boston Marginal Conduit.
- Walter E. Wheeler, . . . In charge of the work on the shut-off dam and the flood sluices at the Dam.
- Walter N. Charles, . . . In charge of the Bridge Street office work and calculations.
- Robert E. Wise, . . . Designs, estimates and general office work.
- Bertram I. Hall, . . . In charge of Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment.

Instrumentmen, Draftsmen and Rodmen.

- Frank V. Andrews, . . . Instrumentman.
- Dow H. Nicholson, . . . Instrumentman.
- Arthur E. Tarbell, . . . Instrumentman.
- Ralph W. Emerson, . . . Instrumentman.
- Ernest E. Lotthrop, . . . Instrumentman.
- Sydney W. Bampton, . . . Instrumentman.
- Timothy Guiney, . . . Instrumentman.
- James Hayes, Jr., . . . Instrumentman.
- Daniel P. Kelley, . . . Instrumentman.
- Alphonsus O'Farrell, . . . Instrumentman.
- Frederick H. Burke, . . . Instrumentman.
- Everett H. Fernald, . . . Instrumentman.

William J. Lumbert,	. Instrumentman.
Charles J. O'Donnell,	. Instrumentman.
Horace C. Sawyer, .	. Instrumentman.
Joseph M. Story, .	. Instrumentman.
Albert J. Holmes, .	. Draftsman.
Franklin J. Van Hook,	. Draftsman.
Robert W. Mawney,	. Draftsman.
John Ayer, . . .	. Draftsman.
Robert L. Smith, .	. Draftsman.
Ray E. Shedd, . .	. Draftsman.
Clifford Allbright, .	. Draftsman.
William F. Bowes, .	. Rodman.
Edward S. Brown, .	. Rodman.
John F. Callahan, Jr.,	. Rodman.
Lester S. Daniels, .	. Rodman.
Thomas R. Hazelum,	. Rodman.
Frederick J. Welch,	. Rodman.
Arthur G. C. Chapman,	. Rodman.
George S. Coleman,	. Rodman.
Henry H. Damon, .	. Rodman.
Hubert W. Flaherty,	. Rodman.
Thomas J. Magner,	. Rodman.
George A. Montague,	. Rodman.
Charles W. Morrison,	. Rodman.
John F. O'Connell,	. Rodman.
Robert K. Taylor, .	. Rodman.
Charles M. Upham,	. Rodman.
Ralph W. Wales, .	. Rodman.
Herbert O. Welsch,	. Rodman.
Joseph P. Wood, .	. Rodman.
Ernest N. Briggs, .	. Rodman.
William F. Donovan,	. Rodman.
Walter N. Secord, .	. Rodman.
Francis P. Allen, .	. Rodman.
Edmund A. Arnold,	. Rodman.
George M. Belcher,	. Rodman.
Charles R. Berry, .	. Rodman.
Clifford N. Cochrane,	. Rodman.
Thomas F. Dorsey,	. Rodman.
Elmer L. Ford, . .	. Rodman.
James J. Greene, .	. Rodman.
Campbell Hunt, . .	. Rodman.
Elmer Jacobs, . . .	. Rodman.
Thomas H. Keenan,	. Rodman.
Robert S. Kimball,	. Rodman.
James McKnight, .	. Rodman.
William P. Monahan,	. Rodman.

Charles E. O'Brien,	. Rodman.
William J. Orchard,	. Rodman.
Adolph J. Post,	. Rodman.
John R. Wolff,	. Rodman.
Leon A. Woodward,	. Rodman.
George L. Lawrence, Jr.,	. Rodman.
Peter L. Dillon,	. Rodman.
George H. Gray,	. Rodman.
Carl H. Lovejoy,	. Rodman.
George W. Meserve,	. Rodman.
Buckingham Miller,	. Rodman.
Edward T. O'Keefe,	. Rodman.

Inspectors.

Charles E. Baker, Jr.,	. Engineering inspector, — on dredging.
Leroy P. Henderson,	. Engineering inspector, — on dredging.
Henry M. McCue,	. Engineering inspector, — on dredging.
Frank I. Barrett,	. Inspector, — on pile-driving.
Joseph R. Hews,	. Inspector, — on concrete masonry.
Samuel B. Horton,	. Inspector, — on concrete masonry of Boston Marginal Conduit.
Franklin L. Mason,	. Inspector, on Lock and Boston Marginal Conduit masonry, also on timber for lock-gates and stop-planks.
John P. McKnight,	. Inspector, — on concrete masonry at sluices.
Samuel Taylor,	. Inspector, — on pile-driving.
William A. Kenrick,	. Inspector, — on pile-driving.
Walter A. Livermore,	. Inspector, — on pile-driving and masonry.
George O. Souci,	. Inspector, — on pile-driving.
Thomas L. Whelan,	. Inspector, — on pile-driving and masonry.
Martin F. Culbert,	. Inspector, — on masonry.
Edwin W. Ellis,	. Inspector, — on pile-driving.
John H. Marks,	. Inspector, — on concrete masonry.
Roy C. Aiken,	. Inspector, — on concrete masonry.
Clarence I. Peckham,	. Inspector, — on concrete masonry.
A. Lincoln Shedd,	. Inspector, — on concrete masonry.
Bernard E. Grant,	. Inspector and timekeeper.

Electrical Assistants at the Dam and Lock.

Henry H. Hoelscher.
 Orrin P. Gifford, Jr.
 Charles E. Taylor.
 Charles B. Wagner.

Stenographers and Clerks.

Jennie L. Rawson,	. Stenographer and clerk, — administrative work, accounts and letters.
Mabel F. Paton,	. Stenographer and clerk.

Edith F. White,	. .	Stenographer and clerk.
Helen B. Choate,	. .	Stenographer and clerk.
Ruby H. Graves,	. .	Stenographer.
Herbert A. Main,	. .	Stenographer and clerk.
John J. O'Neil, Jr.,	. .	Stenographer and clerk.
Alfred Wm. Treen,	. .	Clerk.
F. Howard Guibord,	. .	Messenger.
William J. Fonseca,	. .	Messenger.

Two of the engineering force mentioned above died during the year, — Edward T. O'Keefe, on April 18, of typhoid fever, and Horace C. Sawyer, on October 11, of tuberculosis. They were valued and faithful employees, and their deaths were serious losses to the engineering force.

In addition to the above regular employees, Mr. Herbert L. Sherman, 12 Pearl Street, Boston, continued to have charge of the cement testing and of such other testing as required chemical analysis; Stowell & Cunningham, of Albany, N. Y., were employed as inspectors on the lock-gates and the structural steel for the upper and lower lock-gate houses; Mr. William R. Conard, of Burlington, N. J., was employed as inspector of cast-iron pipe and specials and drain valves; Mr. Squire Howarth, 7 Regent Square, Roxbury, an expert machinist, inspected material being made at various foundries and machine shops; and Prof. C. E. Fuller, of the mechanical engineering department of the Massachusetts Institute of Technology, made such physical tests on steel rods, cast iron, bronze, etc., as were necessary.

The principal engineering office was continued at 367 Boylston Street, Boston. The field office at 12 Bridge Street, East Cambridge, was continued throughout the year. The field office at 108 Chestnut Street was discontinued July 29, owing to the sale of the property, and the engineering force at this office was moved to 12 Bridge Street.

The two gasoline launches, "Craigie" and "Lechmere," continued to furnish satisfactory transportation to and from all parts of the work, having been overhauled and refitted in the early part of the year.

DAM AND LOCK.

A considerable portion of the time of the office force was devoted to preparing designs, plans, estimates and specifications for steam piping at the Lock and sluices, a submerged salt water intake at the sluices, a lubricating system for the lock-gates, a winch for the small boat lock, decks for the lock-gates, temporary and permanent roadways on the Dam, connections between the Harbor wall and the Boston Elevated Railway Company's piers, roadway gates for the drawbridge, and a 60-inch cast-iron pipe submerged outlet below the Dam for the Cambridge Marginal Conduit; studies for the drainage of the Dam, the open shelter at the Dam, and a 2-inch pump in the upper lock-gate house; supervising the installation of the steam piping, supervising the tests on the tightness of the lock-gates, the strength of the lock-gate chains and the capacity of the pumps, and supervising the installation of the operating machinery; preparing rules for the operation of the Lock, and miscellaneous details.

The condition of the work on the Dam and Lock at the end of the year was as follows:—

The shut-off dam was completed. The flood sluices were in operation. The Lock and drawbridge were in operation, but from a temporary operating tower, as the permanent building had not been completed. The filling on both sides of the shut-off dam was largely completed. The rest pier had been completed. The Basin wall, below the coping, with the exception of a gap east of the flood sluices on the Cambridge side to admit scows entering to deposit material within the cross-section of the Dam, was completed. Very little of the Harbor wall was completed, except that between the sluices and the Cambridge shore. Both of the houses to be erected over the lock-gate recesses were nearing completion.

Coffer-dam at the Boston Side of the River.

Early in March the work of removing the coffer-dam was commenced, the stop-planks at the upper and lower ends of the Lock being sufficient to keep out the water until the lock-gates

were completed and ready for operation. At the end of the year most of the coffer-dam had been removed to the extent necessary.

Lock.

During the cold weather a portion of the riprap at the approach to the Lock was laid before the removing of the coffer-dam was commenced.

Early in March the sump holes in the bottom of the Lock connecting with the contractor's underdrain were all filled with concrete and the water was allowed to rise against the stop-planks at the ends of the Lock. In order to take care of the leakage through these stop-planks, a 4-inch centrifugal pump operated by an electric motor was temporarily installed, which, with the assistance of the 2-inch automatic electric pump in the small pump-well, was able to take care of all the water. As soon as the concrete apron being constructed by the Boston Elevated Railway Company between their two piers at the lower end of the Lock was finished, in the latter part of August, the stop-planks at each end of the Lock, together with the girders and trusses, were removed, and the Lock was opened to navigation on September 1, since which time all vessels passing up and down the river have passed through the Lock. The progress of the work on the shut-off dam, however, caused the tidal currents passing through the Lock to be so great as to render navigation difficult, and two dolphins were constructed, one on each side of the channel between the temporary bridge and the Lock, and the towboat "Edwin L. Pilsbury" was employed to assist navigation. During November, after the gates in the shut-off dam were lowered, a rolling fender was provided along the upper end of the rest pier, and three dolphins were driven above the rest pier on the extension of the easterly line of the Lock, to enable barges to get in position to enter the Lock from the upper end without approaching too near the upper lock-gate. With these precautions, navigation through the Lock was maintained without injury or serious delay.

Rest Pier.

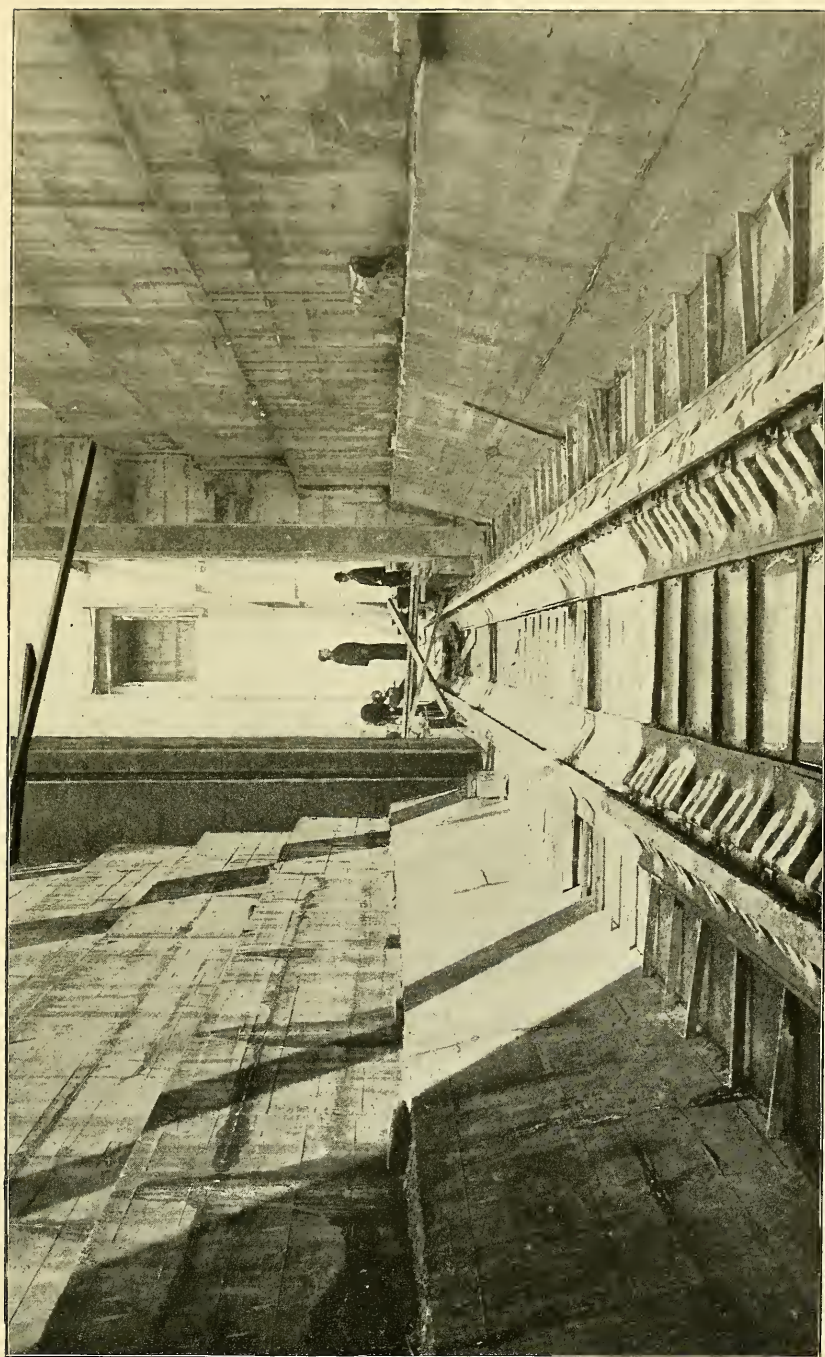
In the early part of the year, a rest pier about 175 feet long was designed. It consists of a timber platform, supported by piles, carrying a stone masonry wall with a concrete backing along the front and a concrete base covered with coarse gravel at the back. Its construction was undertaken by the Holbrook, Cabot & Rollins Corporation under Contract No. 1.

About the middle of March the dredging and driving of piles for the rest pier was started. The bottom of the river at this point was very hard, and a portion of the piles at the upper end rested directly upon what appeared to be the top of a slate ledge, and in order to hold these piles in place concrete was placed by a diver around the foot of each pile. Gravel and riprap were placed on the slope under the rest pier around the piles, then a timber platform was placed over the piles, and the concrete and stone masonry of the pier were commenced in the early summer, and the entire pier was substantially completed by the last of August.

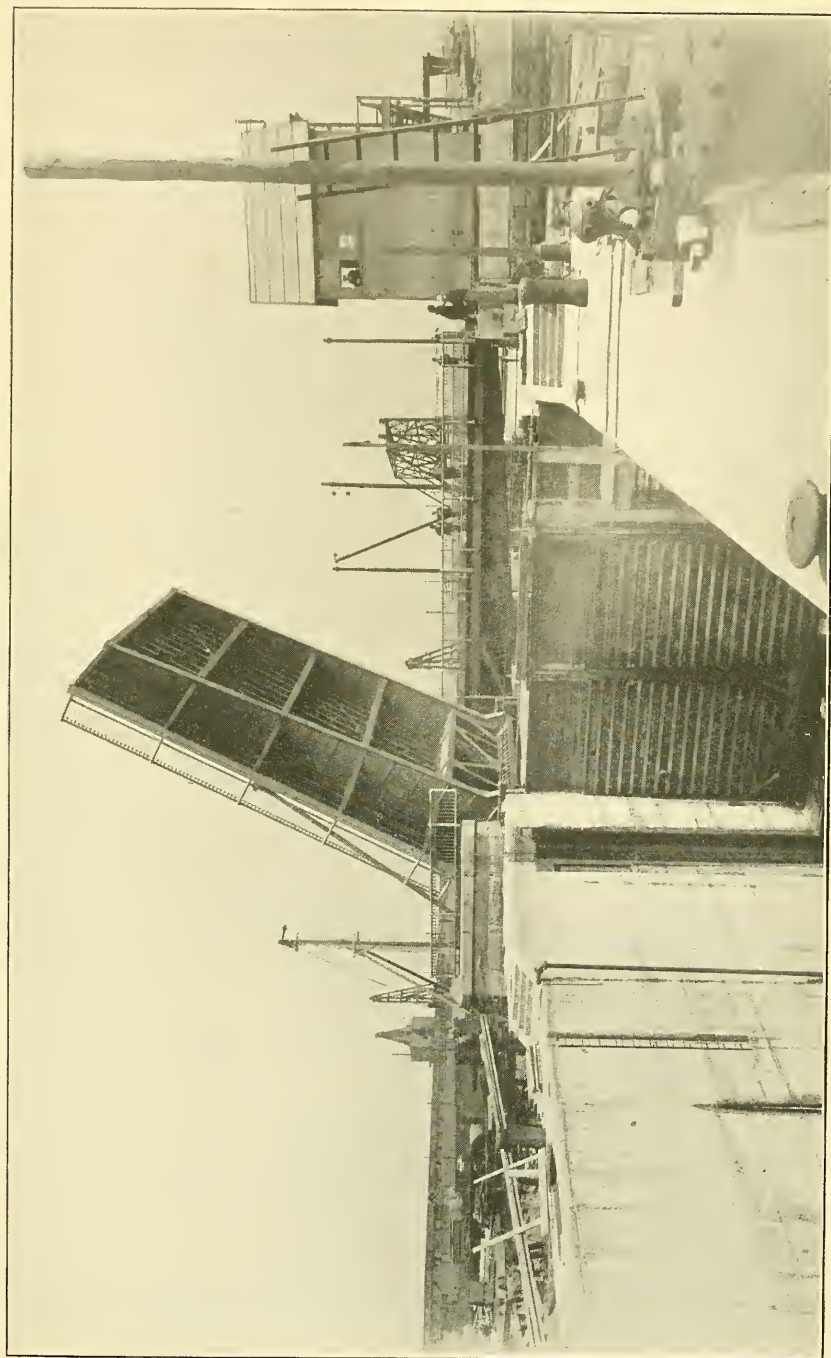
Lock-gates.

After a careful investigation had been made of all the types which have been used, it was decided to build a steel caisson gate, moving on its own longitudinal axis into a recess in the Lock wall. This type of gate requires less room for operation than the ordinary mitring gates, of which double pairs would have been necessary to take the pressures in both directions, and could be more easily kept warm during the winter, as the operation of the Lock is required throughout the year.

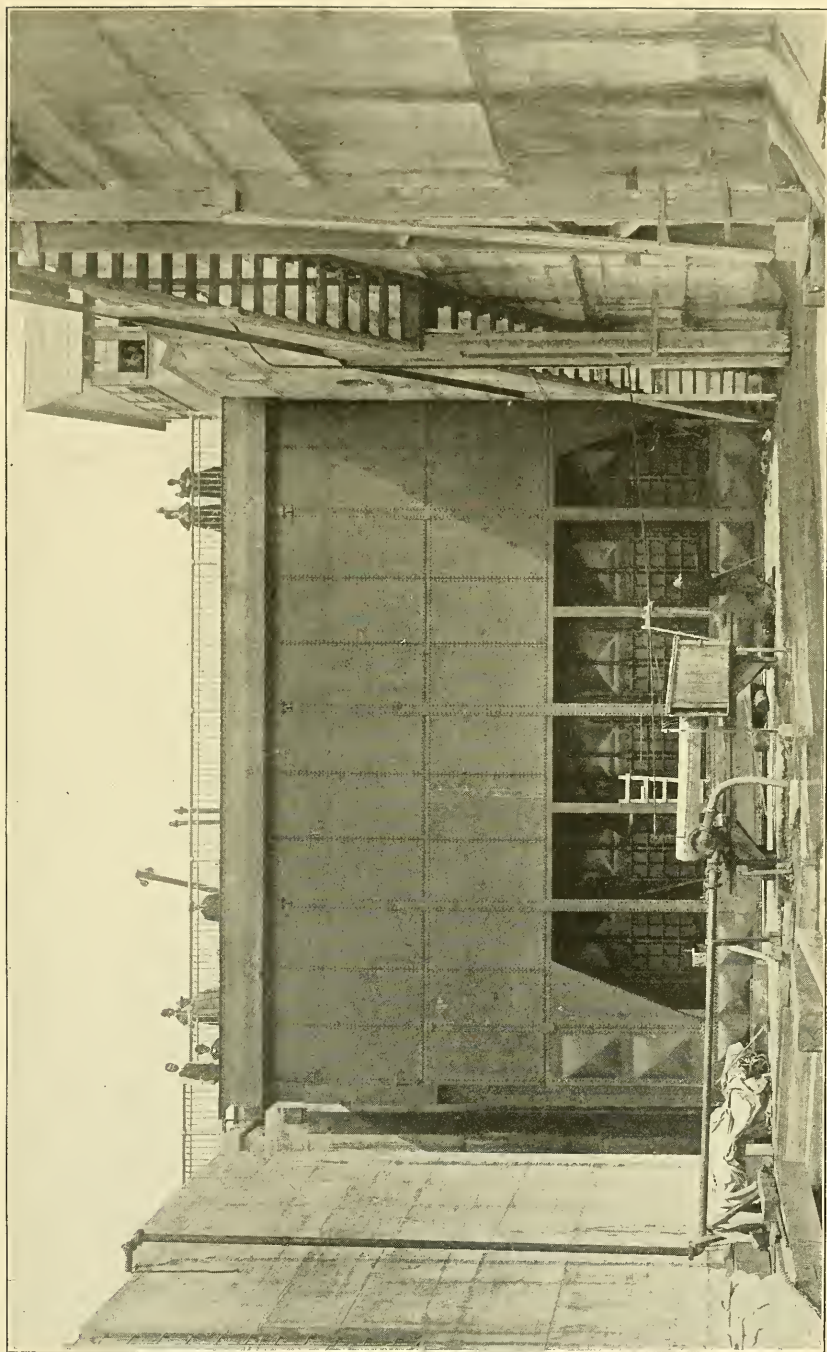
After the general type of gate was decided upon, the methods of supporting and moving it were considered. Three practicable methods of supporting gates of this general type have been satisfactorily employed. The caisson may be supported like a railway car upon trucks attached to its under side; it may rest upon rollers set at close intervals in the masonry under it; or it may be hung upon trucks attached to its upper part and running upon an overhead track supported upon a retractile drawbridge, which, after the gate is opened, may also be pulled back to allow the passage of vessels through the Lock. The



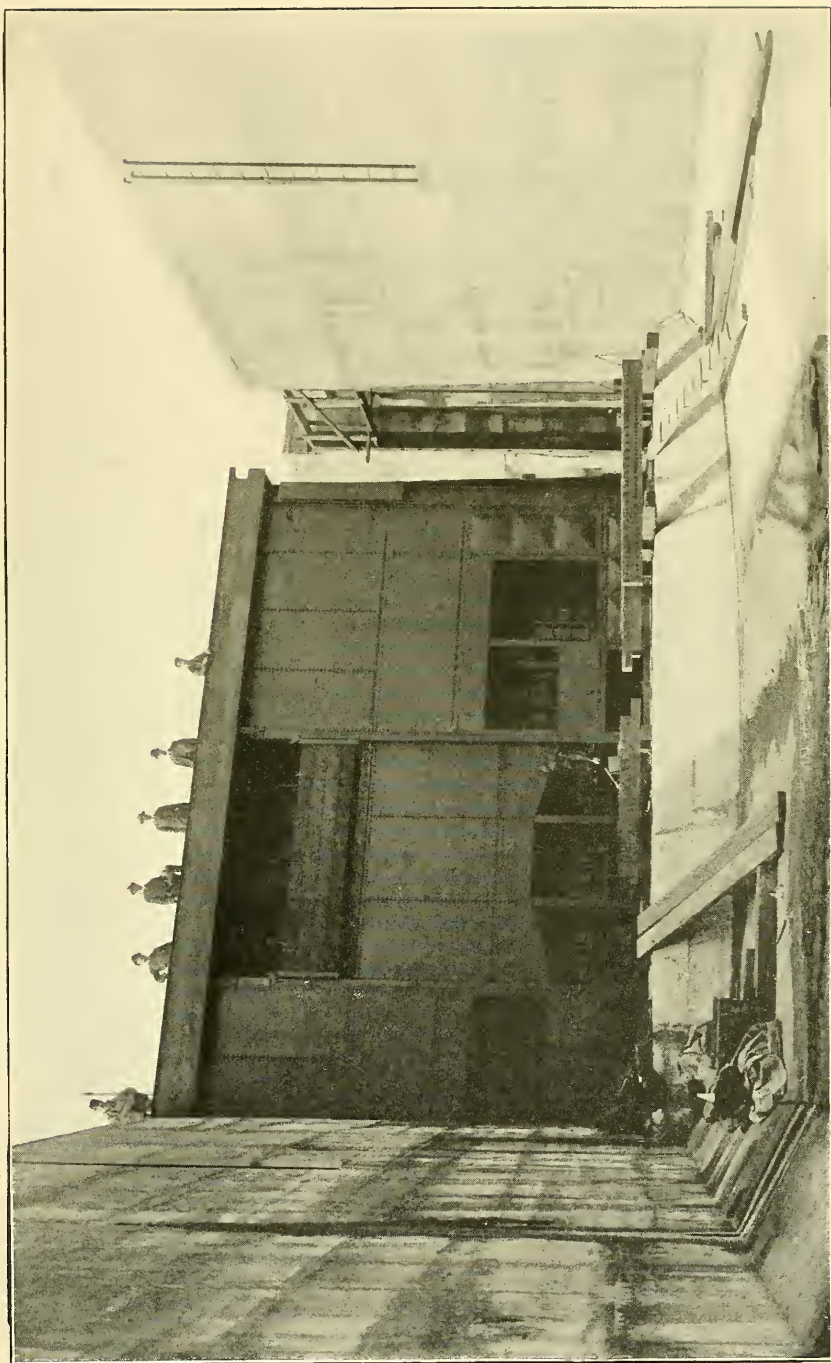
LOCK—RAILS AND CHAIRS IN LOWER GATE RECESS, LOOKING TOWARD LOCK.



DRAWBRIDGE, AND LOCK STOP-PLANKS.



LOCK—LOWER GATE PARTLY CLOSED.



LOCK—UPPER GATE PARTLY CLOSED.

first method, that of supporting the gate upon trucks underneath it, seemed to offer many advantages over the others and was adopted.

Each gate is a steel structure, composed of two main horizontal girders, several main vertical girders between them, and a frame of small girders and beams, all covered over with the skin plates. The upper part is a double-skin gate and the lower part is a single-skin gate, except that at both ends plates are carried down on both sides to form passageways to and chambers about the trucks. The elevation of the lower lock-gate is shown by photograph entitled "Lock—Lower Gate Partly Closed," the upper lock-gate by photograph entitled "Lock—Upper Gate Partly Closed," and the rails and rail chairs by photograph entitled "Lock—Rails and Chairs in Lower Gate Recess, Looking toward Lock."

Manholes are provided in the girder webs, and there are iron ladders in the compartments making it possible to go from the deck to the truck very easily. The intermediate compartments form air locks. The truck chambers, open underneath and closed above, act on the diving-bell principle, so that by pumping in air at the necessary pressure the water may be forced out and the trucks examined at any time. The depth of the water below the compressed air surface at the bottom of the truck chambers will be only about 15 inches over the concrete and 1 inch over the tops of the rails, so that the track, too, can be examined. This permits the recess across the bottom of the Lock to be cleaned of any sediment which may accumulate in it, without going through the expensive operation of putting in the stop-planks at the ends of the Lock and pumping it all out. A man may stand between the axles of the truck, some 25 feet below the level of the water outside, and may walk along with the gate as it moves.

Under the ordinary conditions of loading on the gate, due to the pressure of the water, the vertical end girders and the horizontal bottom girder are supported throughout their length against the sill, while the other girders and beams are supported at both ends. If it is assumed that one of the gates is for some reason out of commission and withdrawn into its recess for repairs, it is still possible to open the other at times

when the elevation of the tide is the same as that of the Basin and to allow a vessel to pass through the Lock. It may happen that, by the time the vessel is through and the gate started back to its place across the Lock, the tide may have fallen appreciably, and that by the time the gate is nearly closed it may have fallen enough to cause such pressures on the gate that it cannot be moved further, either to finally close it or indeed to move it in either direction, until the tide rises again to the point where the pressures on both sides of the gate are nearly equal.

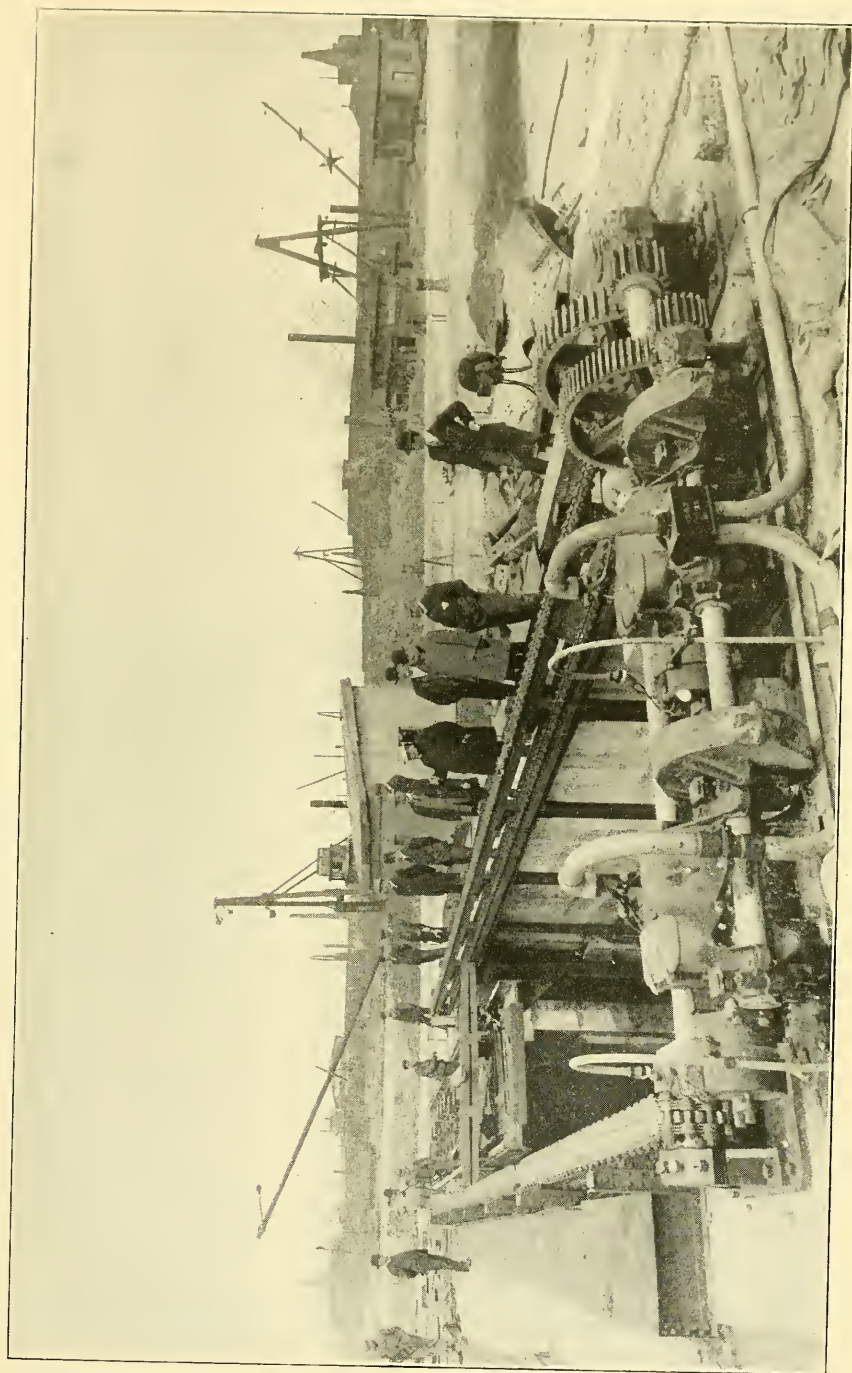
This same condition may intentionally be obtained if, at a time of some excessive upland flood, the sluice area through the Dam be found insufficient and the lock-gates left partly open while the tide falls so as to provide additional opportunity for the water in the Basin to get out.

Under such conditions the top girder of the gate becomes a cantilever, supported upon suitable adjustable bearings arranged in the recess walls and having for loads upon it the top reactions of the vertical girders. The horizontal bottom girder is, as before, supported on the sill, and all the vertical girders are supported at their ends.

The possibility of having the gate hung up in this way explains the overhanging end of the top girder, which shows in photograph entitled "Lock — Upper Gate Operating Machinery and Gate Recess," while the fact that such loadings may occur with the gate in *any* position and that the reactions may consequently be applied at any points of the top girder gives the reason for the peculiar flange section which was adopted. As it was not practicable to place stiffeners at every point of application of a reaction which may act at any point of the girder, and as the reactions will be very large, a flange section had to be devised to satisfy the following requirements: —

(1) The number of flange rivets through the girder web between stiffeners must be great enough to load the web to its full capacity.

(2) The flange must be strong enough as a beam to carry the remaining load, not taken directly by the web between stiffeners, to the stiffeners.



LOCK—UPPER GATE OPERATING MACHINERY AND GATE RECESS.

(3) The webs of the flange channels must be so thick that, under the maximum possible reaction, they will not buckle or crush outside the outer line of rivets.

Each flange consists of two 15-inch by $\frac{7}{16}$ -inch plates, two 15-inch, 50-pound channels, one $\frac{3}{8}$ -inch plate to support the deck over the top of the gate, and one 14-inch by $\frac{7}{8}$ -inch plate. The channels and the $\frac{7}{16}$ -inch plates were riveted together by countersunk rivets and planed on the outside or bearing faces before being assembled on the girder, so as to insure the proper distribution of the reactions. The reactions decrease rapidly as the gate moves back into the recess, and the $\frac{7}{16}$ -inch plates were omitted as soon as the channels alone sufficed.

The gates are heated internally by steam radiators, placed near the skin plates, which will give out heat enough to prevent ice from forming within a foot of the gates.

The heating coils in the lower gate have a radiating surface of 1,000 square feet and those in the upper gate have a radiating surface of 650 square feet.

The axles of the trucks which support the gate are of forged Parsons' manganese bronze. This metal was used, since, while possessing all the physical properties of medium steel, it does not deteriorate in salt water. The strength of the axles, therefore, will not decrease as would the strength of the steel axles, and there will be no possibility of rust preventing them from turning easily in the boxes.

The boxes are lined with Parsons' white brass. The gates will move rather slowly, about a minute being required for opening or closing, and it is possible that the water in which they run would be sufficient lubricant. It was not considered safe to depend upon it, however, and experiments were made upon greases and oils under such low temperatures as obtain under water in Boston in winter. Greases cannot be used, as they become too hard to be forced from the cups even when great pressure is applied. Oils can be used, but it is necessary to select those which do not readily wash out of the bearings. A heavy cylinder oil has been found best for this purpose.

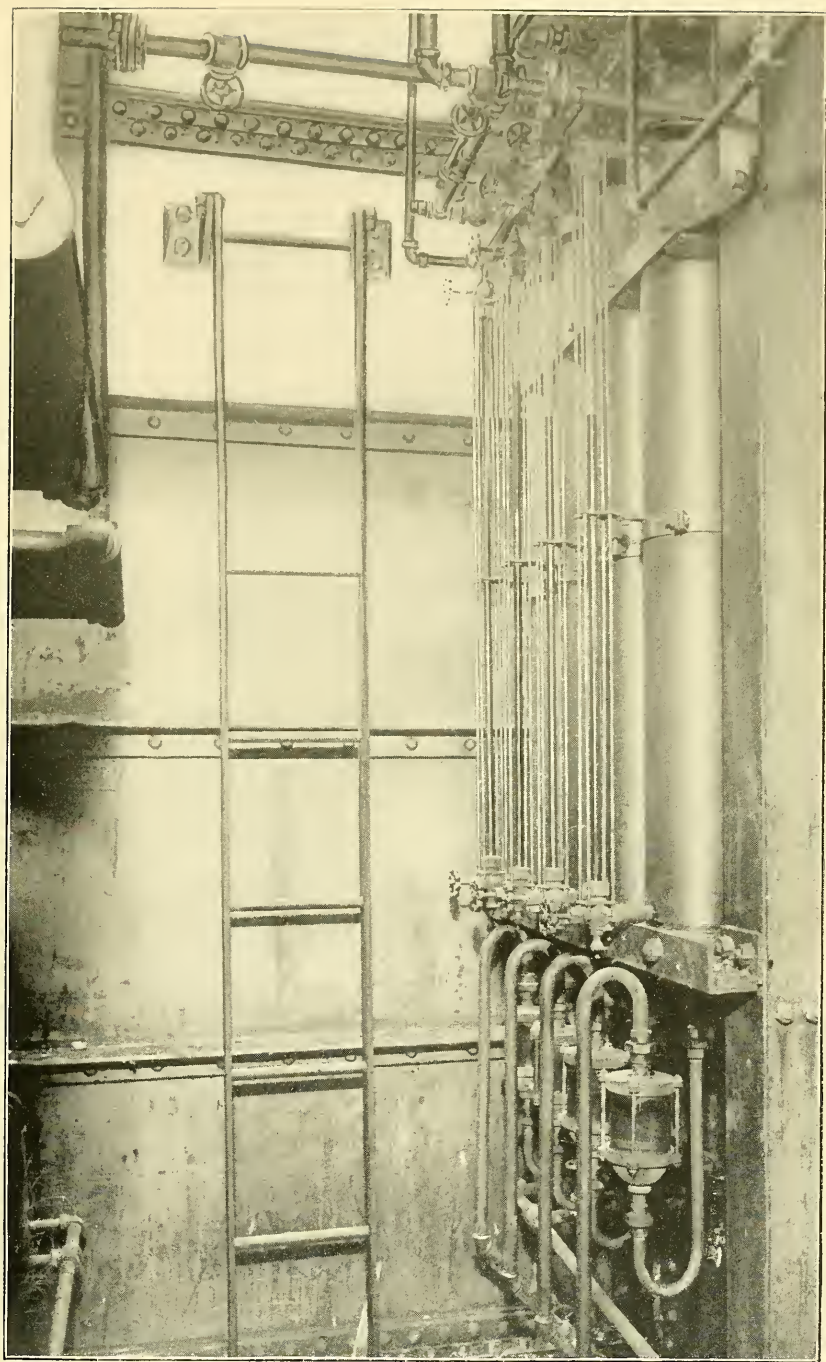
The oiling system consists of oil reservoirs in the upper compartments of the gates, sight-feed cups just below the reservoirs,

and small brass pipes leading down to the truck bearings. The sight-feed cups, which are filled with water through which the oil rises, are shown in the photograph entitled "Lock — Interior of Lower Gate. Truck Lubricating Apparatus." By means of compressed air charged daily into a tank which is connected to the oil reservoirs, the heavy oil is made to flow through the sight-feed cups and the pipes to the bearings. By operating a valve the flow of oil may be varied from a continuous stream nearly as large as a lead pencil to one drop in ten minutes. It has been found best to feed one drop in about two minutes to each bearing.

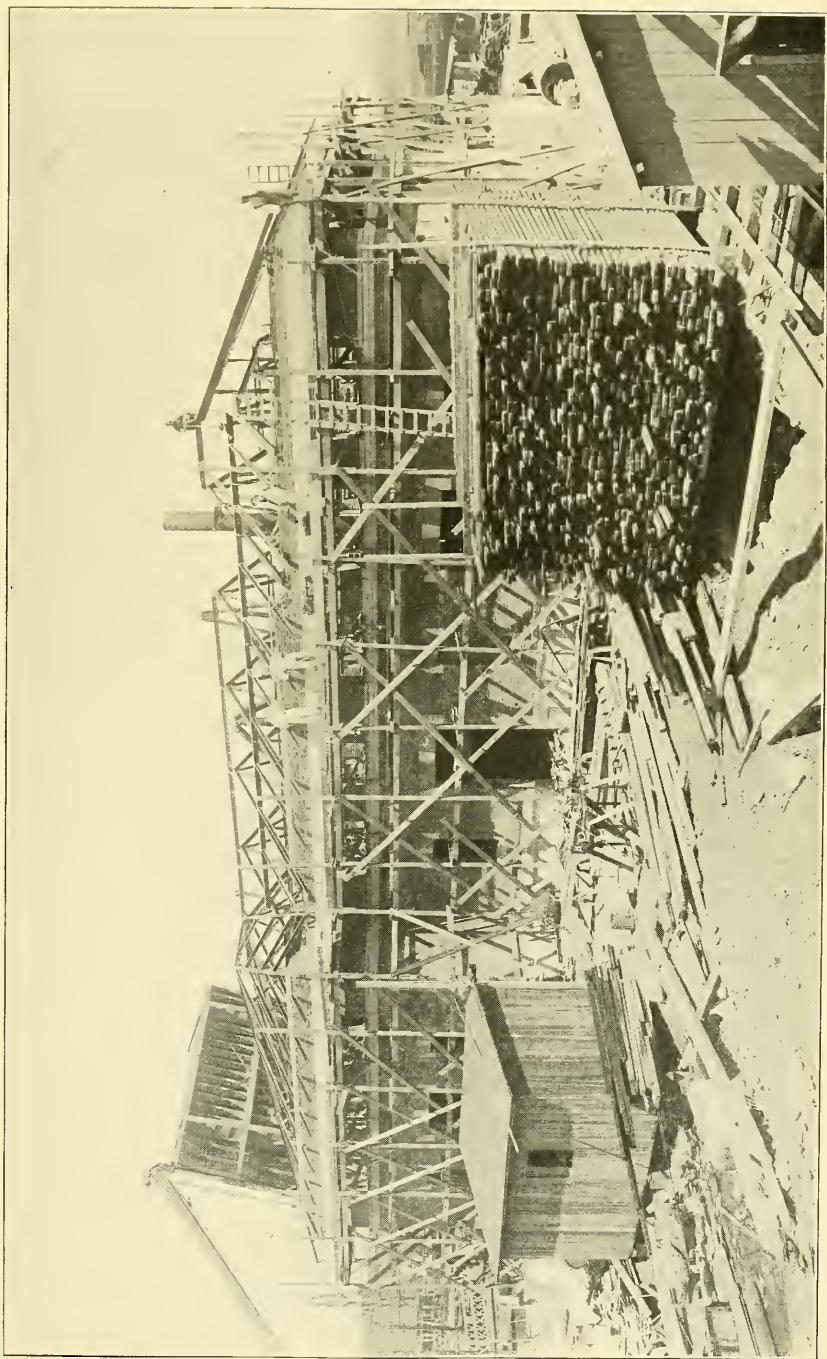
About the edges of the gates are bearing frames of oak which form water-tight joints with similar oak sills and frames in the masonry of the Lock. In order that the gates may roll easily on their tracks, a clearance of about $\frac{3}{4}$ of an inch, or $\frac{3}{8}$ of an inch on each side, was left, the pressure of the water against the gate being depended upon to seat it against the sills and make it tight. With change in direction of pressure, the gate slides over on its bronze axle to bear against the opposite sills, a very small head being required to make the gate move in this way.

The arrangement of the operating machinery for the lock-gates was described in the last annual report of the Commission. This machinery was installed early in the year and was found to work very satisfactorily, the gates moving very smoothly and quietly. The photograph entitled "Lock — Upper Gate Operating Machinery and Gate Recess" shows the machinery for the upper gate.

Material for the lock-gates had been received and the erection was well along at the end of the previous year. The oak bearing timbers to be fastened to the lock-gates were delivered in December and the work of fitting them together and bolting them in place was in progress until spring. During the same time the steel work for supporting the operating chains and the chains themselves were being erected. This work was completed in April, and on April 23 the lower lock-gate was moved by its own motors. On June 5 the lower lock-gate was run across the Lock and the timbers adjusted. Meanwhile the upper lock-gate was completed so that it could be moved early in May, and early in the fall the entire lock-gates, with their con-



LOCK—INTERIOR OF LOWER GATE. TRUCK LUBRICATING APPARATUS.



LOCK — LOWER LOCK-GATE HOUSE.

trolling apparatus, and the gates in the lock-gates to be used for emptying and filling the Lock, were in condition so that the entire plant could be operated.

Heating Plant.

At the end of the year the boilers, stack, flue, fan and fan by-pass had been erected and steam had been turned on to be used to heat the lower lock-gate house by radiators with temporary connections. The radiators inside both lock-gates and the connections from the boilers to the lock-gates had been completed and steam was also connected to the lock-gates. A 3-inch by 2-inch by 3-inch Deane horizontal duplex piston pump had been put in place to pump the condensation from the heating system of the lower lock-gate house back into the boiler. Scales for weighing the coal had been placed in the boiler room.

Lock-gate Houses.

The preparation of the contract plans and detail drawings required a large amount of time, as some one hundred finished drawings and forty-seven full-size details were required.

The house over the lower gate recess is considerably larger than the one over the upper recess, as it is to serve not only to protect the gate and machinery, but for many other purposes. In the east end of the basement is the boiler room, in which are installed the two 50 H. P. horizontal return tubular boilers which furnish heat to the buildings, the lock-gates and the sluices. On the floor above are located the offices for the superintendent, the machine shop, men's dormitory and lounging room and the living apartment which may be occupied by the superintendent and his family.

The next floor above is the attic, which gives storage room for patterns, tools, etc. In one of the tower rooms are located the air compressors which furnish the air by which it is possible to visit the lock-gate trucks in their "diving-bell" chambers, and for forcing the oil to the bearings, for driving tools and for other purposes.

In the room at the top of the tower are located the switchboards and controllers by means of which the movements of

the drawbridge, the lock-gates and the lock filling gates are directed. The operator in this room has an unobstructed view in all directions and can see vessels approaching the Lock long before they arrive there. Electrically operated gages indicate to him the height of the water in the Basin, the Lock and the Harbor, so that he can tell at a glance if the gates should be moved, and electric signals show him the position of the lock filling gates which are hidden under the water.

The upper house is hardly more than a shelter for the lock-gate, its machinery, and the operating stands of the two big sluice-gates in the Basin connection of the Boston Marginal Conduit.

Cambridge Cofferdam.

Early in the spring dredging and other work connected with the removal of the Cambridge coffer-dam was started. This work progressed from time to time until by the end of the summer it had been sufficiently removed to permit the free passage of water through the flood sluices.

Sluices.

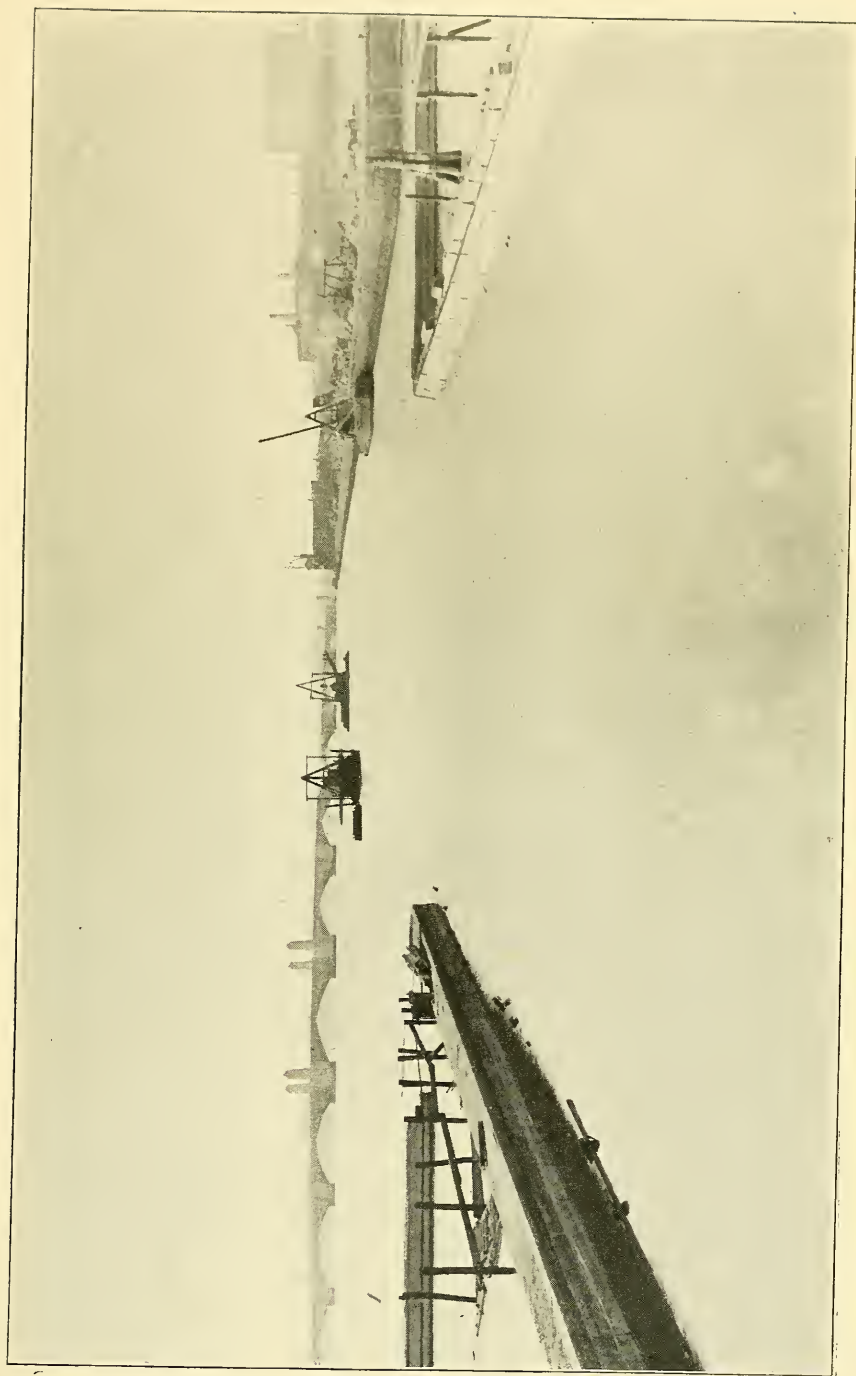
During the winter of 1907-08, the lines of sheeting extending on both sides of the coffer-dam were completed, and a portion of the Harbor wall between the adjacent piers of the Boston Elevated Railway Company was constructed.

A portion of the Cambridge Marginal Conduit was constructed within the limits of the coffer-dam, and concrete was placed for the columns to support the steps on the west side of the sluices.

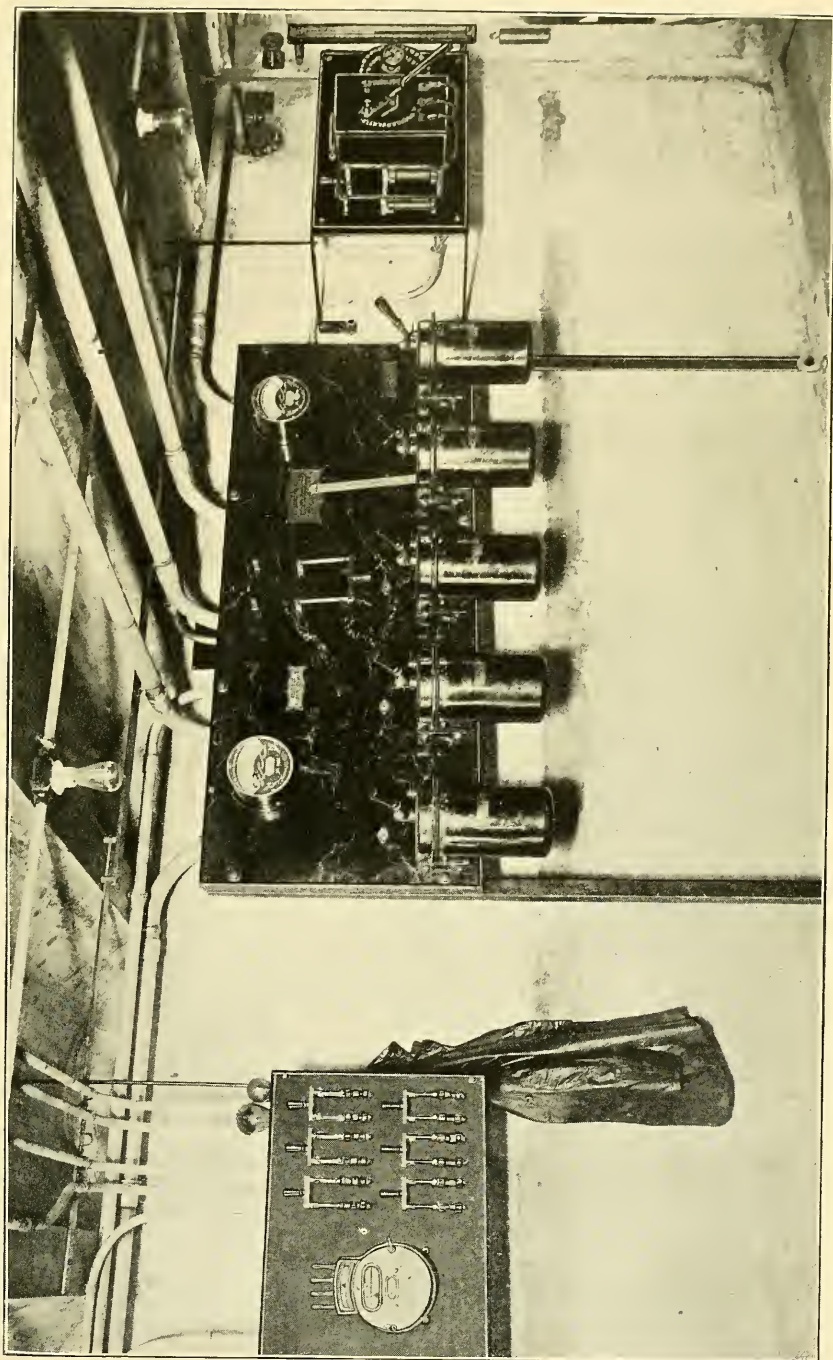
The work of completing the connection between the sluices and the Bridge Street sewer was started early in May and completed in June, the contractor for this work being the Holbrook, Cabot & Rollins Corporation.

The sluice-gates under construction by the Coffin Valve Company and the controlling devices were adjusted and completed early in August.

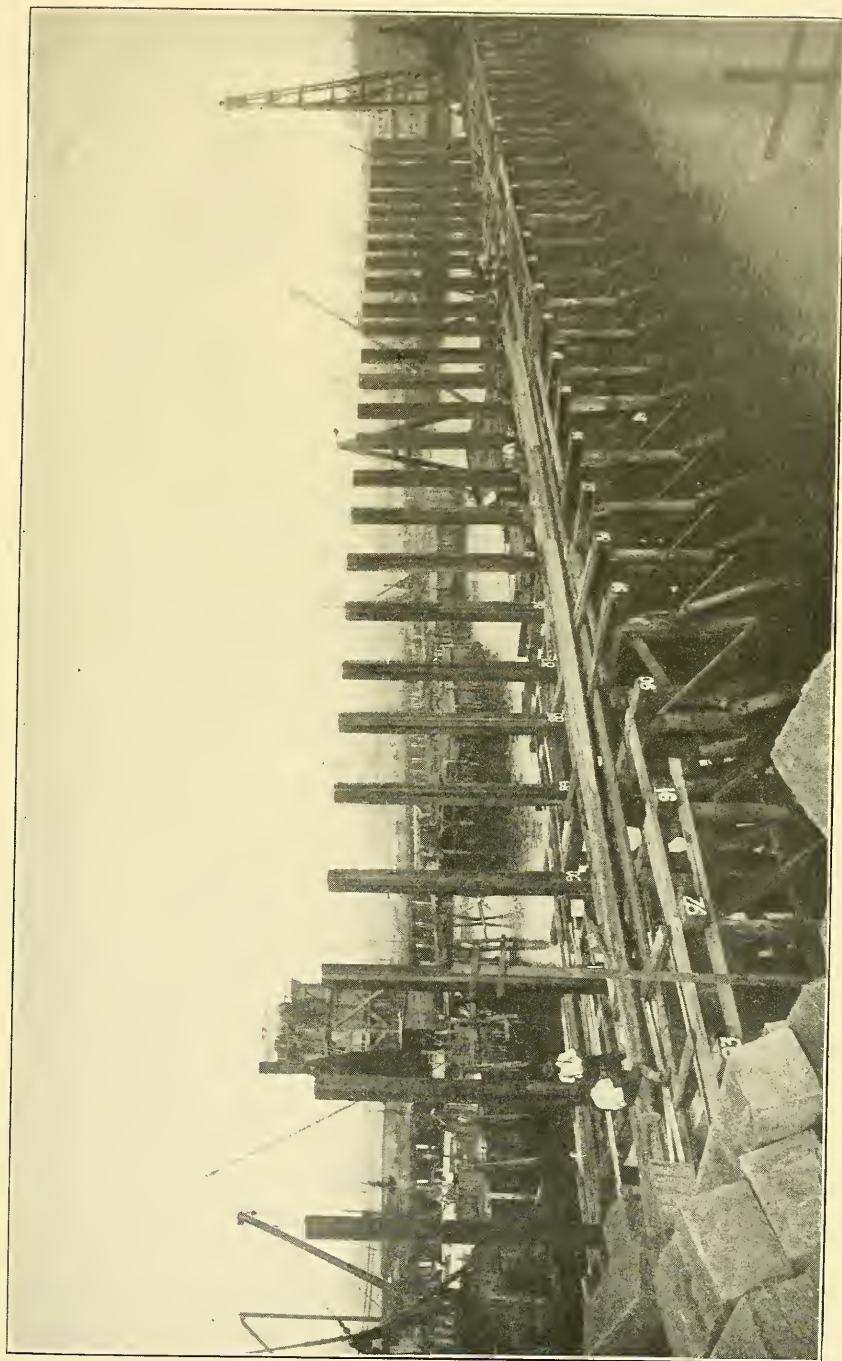
The sidewalk lights under construction by the American Luxfer Prism Company of Illinois were completed early in June.



DAM — WALLS AT APPROACH TO SLUICES, LOOKING UP-STREAM.



SLUICES—SWITCHBOARD FOR OPERATING GATES.



DAM—SHUT-OFF DAM UNDER CONSTRUCTION.

Small Boat Lock-gates.

The small motor and appurtenances to aid in the operation of these gates were installed.

Pumps.

The three pumps, two at the Lock and one at the sluices, were operated when necessary throughout the year but were not accepted.

Shut-off Dam.

In order to arrest the tidal currents so that the portion of the Dam between the Lock and the sluices could be completed, it was necessary to construct a temporary dam. The plan adopted was very different from that originally agreed upon in the contract, the special feature, that of substituting gates for stop-planks, having been designed by Mr. George B. Francis, consulting engineer, 10 Bridge Street, New York, N. Y. This structure is 656 feet in length and consists of a central line of 6-inch yellow pine splined sheeting driven into the bed of the river, supported on each side by a pile structure consisting of either yellow pine or specially large size Norway pine piles, in bents 8 feet on centers. Each bent on each side of the central sheeting consists of three plumb piles, and two spurshore piles with double girder caps of 4-inch by 12-inch yellow pine at about low water, two diagonal braces of 4-inch by 12-inch yellow pine, and one 10-inch by 12-inch or larger yellow pine cap, drift-bolted to the tops of the piles, the whole securely fastened together with 1-inch screw bolts. The process of construction was in the following order: First, the pile structure on one side of the sheeting, from 60 to 100 feet in length, was driven and securely bolted and braced; then, the 6-inch sheeting was driven into the bed of the river with the top of the sheeting a little above elevation 102,¹ where it was firmly held in place by means of temporary 6-inch by 12-inch waling pieces; then the wales at elevation 96 were placed and bolted to the sheeting by a diver, after which the temporary 6-inch by 12-inch wales at elevation 102 were removed, and the portion of the sheeting

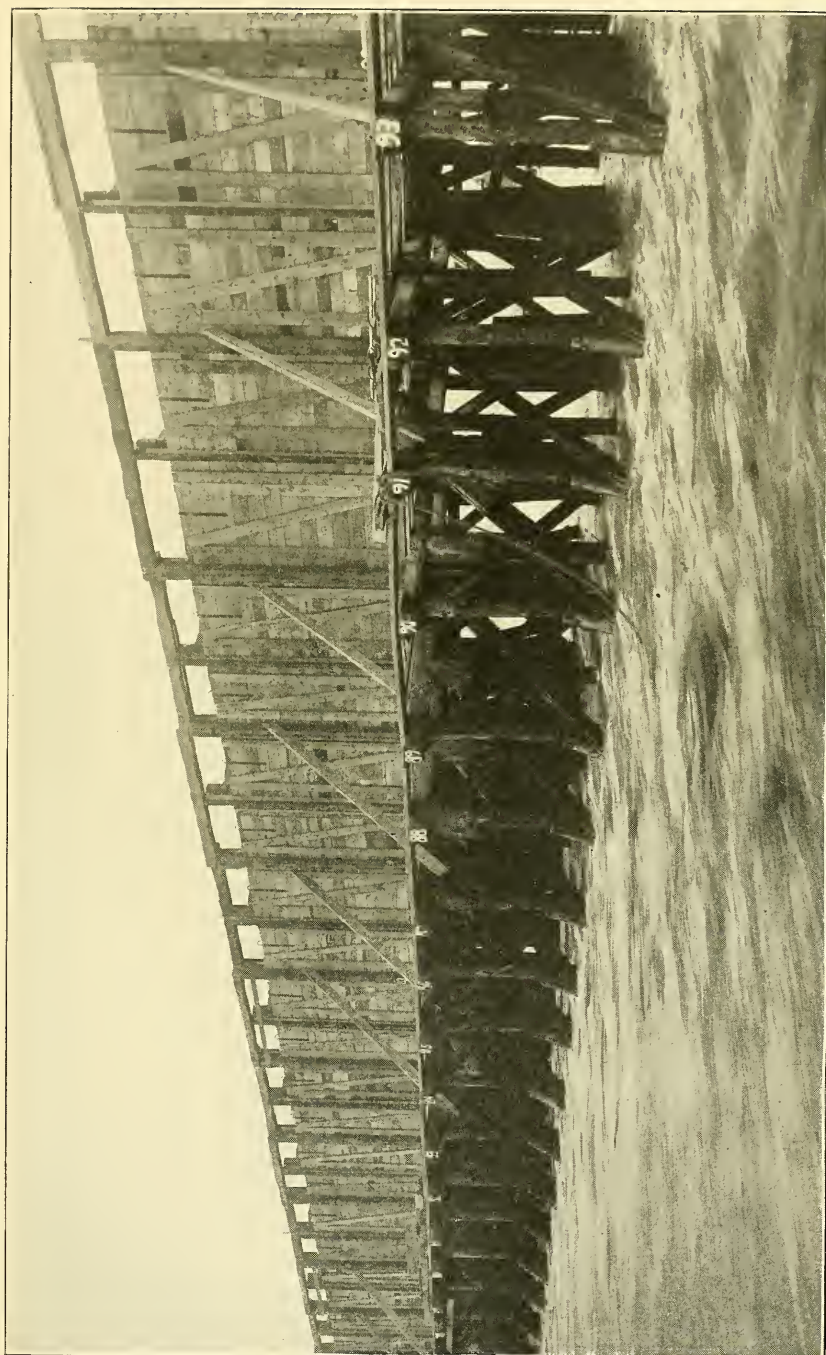
¹ All elevations are referred to a base 100 feet below Boston City Base.

above elevation 97 was sawed off, either by a diver or by means of a pile-sawing machine operating under water. Then the piles in the bents on the opposite side of the sheeting were driven, bolted, braced and capped. While this work was being done, vertical guides were being built on the pile bents. These guides consisted of two 8-inch by 12-inch yellow pine timbers about 32 feet long with a 4-inch by 7-inch yellow pine stick between them, the whole bolted together with $\frac{3}{4}$ -inch screw bolts. Above elevation 115 in alternate bents, one of the 8-inch by 12-inch sticks was changed to 4-inch by 8-inch in order to allow the gates to enter the groove formed by the guides. These guides were then placed in position with their lower ends resting on the wales at elevation 96.5, the upper portion held in position at the top of the pile bents by blocking near elevation 113. Then the space between the guides and center piles of each bent was filled with blocking, and the two sides of the pile structure were fastened together with four 1-inch bolts about 5 feet long, with nuts and washers on each end.

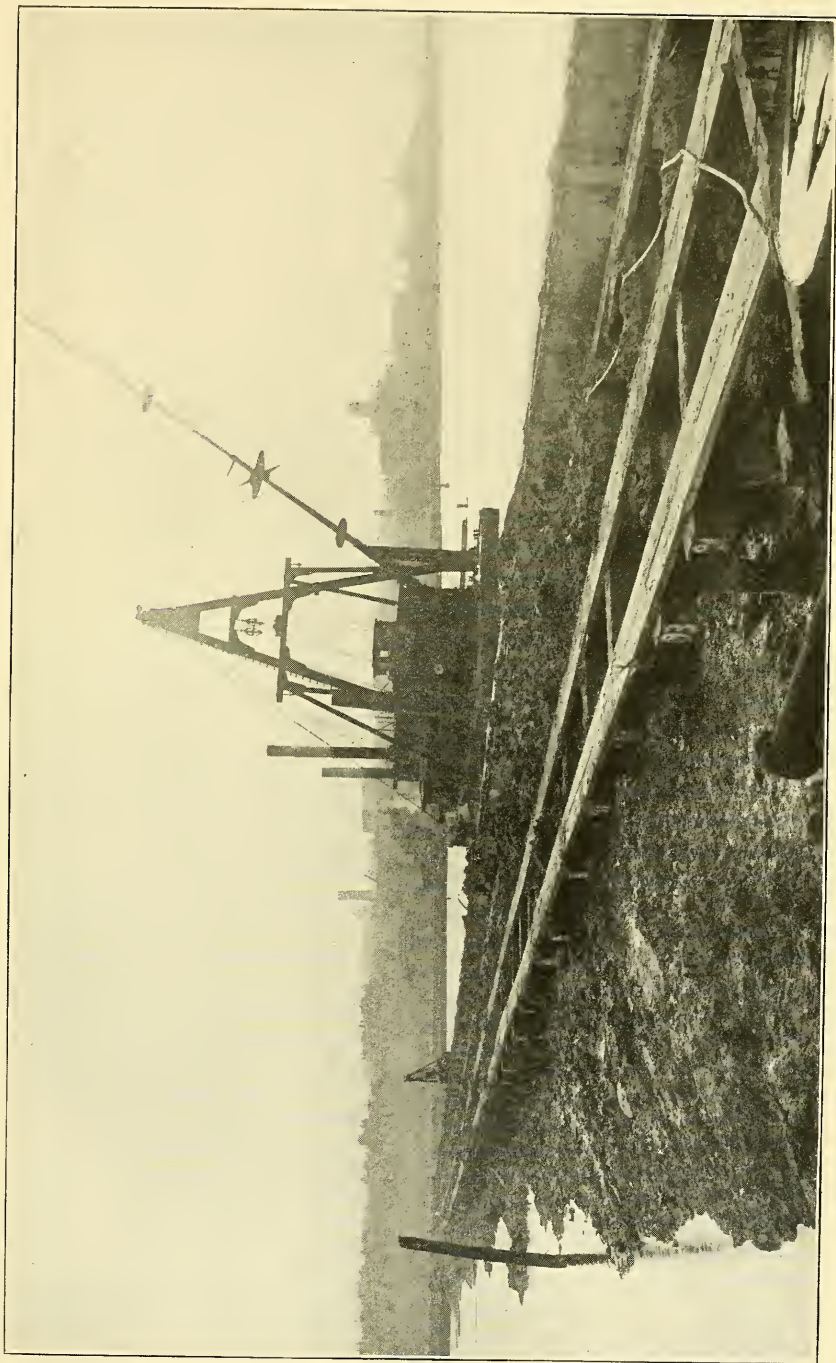
The gates, to be used in the grooves formed by these vertical guides, were built of 6-inch yellow pine sheeting spiked to 2-inch by 10-inch spruce plank, the whole gate being suspended by a rope from a horizontal 10-inch by 12-inch timber, drift-bolted to the tops of the guides. In order to make sure that a reasonably tight joint was made between the bottom of the gates and the top of the sheet-piling sawed off at elevation 97, a piece of $\frac{3}{4}$ -inch rubber hose was tacked to the bottom of the gate, and the fitting of the gate to the top of the sheeting was tested by a diver in each case before the gates were finally lowered.

As soon as the pile structure was completed, filling was started to bring the bed of the river nearly up to the level of the top of the sheeting. This filling consisted of a layer of sand and gravel from 5 to 8 feet thick, with its surface covered with riprap to prevent the filling from being scoured away by the increased velocities caused by the gradual closing up of the river channel.

The driving of piles for the shut-off dam was started early in March, and the first piece of sheeting for the same was driven on Apr. 6, 1908, and from that time on work was con-



DAM—SHUT-OFF DAM BEFORE DROPPING GATES.



DAM — FILLING AROUND SHUT-OFF DAM.

tinuous on this structure, except from April 13 to May 16, during which time work was suspended in order to enable certain other work to be done. As the driving of the sheeting progressed, the sectional area of the river at the site of the shut-off dam was constantly decreased, and during the run of spring tides in the month of July it was noticed that navigation through the draw of the temporary bridge was having difficulty in passing through the draw against the tide, as well as having difficulty in keeping to the channel, and avoiding striking the outer ends of the shut-off dam. In order to assist navigation and to prevent the ends of the shut-off dam from being struck by vessels passing up and down stream, arrangements were made with the Commercial Towboat Company for the use of one of their boats during the run of high tides in the month of August. This towboat began work on August 10 and was continually in service until October 21, after the shut-off dam was completed, as it was found, even after the spring tides were passed, that there was still difficulty in keeping navigation from striking the ends of the shut-off dam, even on neap tides. Some of the velocities observed in the river during the construction of the shut-off dam are given herewith: —

June 15,	2.5	feet	per	second,	spring	tide.
Sept. 3,	2.5	"	"	"	neap	"
" 10,	4.6	"	"	"	spring	"
" 25,	4.2	"	"	"	average	"
Oct. 3,	4.4	"	"	"	neap	"
" 8,	6.5	"	"	"	spring	"

Prior to August 31, all of the flow of the river passed through the shut-off dam, but on September 1 the Lock was opened to the river flow, which gave 585 additional square feet below elevation 100 and relieved the flow through the shut-off very noticeably. By the end of September, the sheeting of the shut-off was all driven, except for about 100 feet, and most of the gates were built for nearly 500 feet of the structure. After considerable discussion as to the best method of driving the last 100 feet of sheeting, it was decided to drive, first, single pieces of plumb plank opposite each bent of the structure with their tops held firmly in place by permanent waling pieces at eleva-

tion 102 and temporary waling pieces about elevation 110. Then the spaces between the plumb plank were carefully measured, and sheeting selected to just fill each opening and spiked together with 2-inch plank. On the morning of October 2, when the predicted tides had a range of about 8 feet, two pile-drivers and two lighters began the work of driving this last 100 feet at 8 A.M., about one hour before low water, and completed the entire distance at 10 A.M., about one hour after low water. Each lighter picked up a block of sheeting 8 feet wide and 32 feet long and entered the splines on each side of the block into the grooves of the plumb planks previously placed. Then the pile-driver began the work of driving the sheeting down while the lighter was placing the next block, and so on. One lighter and one pile-driver started at one end of the 100-foot gap, and the other lighter and pile-driver started in the middle of the gap, and all worked in the same direction and finished at about the same time. This portion of the sheeting was cut off at elevation 102, which was 5 feet higher than the rest of the shut-off, and the gates were correspondingly 5 feet shorter.

The entire length of the shut-off dam was made up of 82 gates about 8 feet on centers.

On the morning of October 20, forty-one men with axes were assigned to their stations on the frame from which the gates were suspended, and each man was instructed on a given signal to cut the ropes that held two gates, after which he was to come down, fasten the gates in place with wedges and see that each gate was completely closed. At 11 A.M. the signal was given and in two seconds all of the gates were down; in two minutes they were all wedged securely in place. The frontispiece shows the actual shut-off in progress. A large plant immediately began the work of placing earth fill next the shut-off dam. Within a week the fill was well up to ordinary high water, and before the next run of high tides the fill was made nearly complete. There has been no appreciable movement of the structure since the filling has been in progress.

TEMPORARY BRIDGE.

✓ The temporary bridge, including the draw, was maintained during the year. About 148,000 feet B. M. of spruce plank were used in replacing the wearing surface of the roadway. Monthly inspections were made of the piles and timbers under the bridge, and repairs were made as needed.

On Dec. 14, 1907, the drawtenders' force was placed on an 8-hour basis.

✓ On two occasions during the year vessels passing through the draw came in contact with the trolley wires, causing a short circuit and a delay of several hours to the operation of the surface cars over the bridge; otherwise the traffic was maintained continuously throughout the year.

BOSTON MARGINAL CONDUIT AND BOSTON EMBANKMENT.

Plans and specifications for the last section of this work, known as Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment, were completed and bids were opened on Jan. 20, 1908. Plans and specifications were also drawn for the submerged outlets extending the overflows from the marginal conduit 100 feet out from the embankment, to permit the discharging of the overflow from the conduit into the bottom of the river.

Studies for a gate-house over the connection between the Stony Brook channels and the Boston Marginal Conduit were being prepared at the end of the year.

In order to properly control the flow in the various conduits which connect at the Fens gate-chamber, the construction of which was included in the work above mentioned, five large sluice-gates are necessary. These were designed by the engineering force of the Commission and contracts made for the gates, motors and controlling devices.

Specifications for the submerged outlets from the overflow chambers of the Boston Marginal Conduit were prepared and a contract made with Hiram W. Phillips, of Quincy, Mass., for doing the work.

Stony Brook discharges into the Charles River at the Fens through a masonry channel of horse-shoe section 12 feet wide

and 12 feet high, known as the Stony Brook Conduit. Beside this conduit is another of circular section 7 feet in diameter, known as the foul flow conduit. These conduits carry, in dry weather, a rather small stream of foul water, but in time of storm this stream becomes of considerable size, consisting of storm water and the overflow from sewers.

The gate-chamber at the Fens, referred to above, is so arranged with automatically controlled, positive sluice-gates, described below, that the ordinary dry weather flow of Stony Brook will be turned into the Boston Marginal Conduit, but whenever the water becomes higher than the Basin level it will, at least in part, run directly into the river. It may all be made to run into the river by closing one of the positive sluice-gates.

The foul flow conduit carries a stream of objectionable character which is intended at all times, so far as practicable, to be taken into the Boston Marginal Conduit. Channels and sluice-gates are provided, however, so that if desirable the flow may be directed into the river. This might be necessary if the Boston Marginal Conduit were to be emptied for an inspection. The gates controlling this flow will be interlocked so that in no case can they both be shut at one time, thereby blocking the foul flow conduit.

As stated above, the flow from the 7-foot foul flow conduit and from the Stony Brook Conduit will ordinarily be taken into the Boston Marginal Conduit and delivered into the tide water below the Dam.

In the event of a severe storm, causing a flow greater than the Boston Marginal Conduit can carry off, these two channels will discharge, at least in part, into the Basin, and the special overflows which have been provided along the Boston Marginal Conduit will begin to act and the surplus will be emptied into the Basin, but the flow will by this time have become so diluted by the storm water that no nuisance will ensue.

These special overflows are so arranged that they will draw from the middle of the conduit, thus avoiding the sediment which will move near the bottom and the floating material at the top, discharging into the Basin the cleanest part of the water flowing in the conduit.

The object of the sluice-gates at the Feus is to control the flow of water through rectangular openings 6 feet, 4 inches wide by 7 feet, $8\frac{1}{4}$ inches high. Each gate consists of the frame attached to the masonry, the valves, guides for the valves and the machinery for raising and lowering it.

The frame is of cast iron, each of the four sides being an L section, the outer leg of which forms a flange which bolts to the masonry about the gate opening and the inner leg of which forms a spigot which is embedded in the masonry. Around the inner edge of the flange is a bronze facing which forms a bearing surface for a corresponding bronze facing on the gate and makes a water-tight joint. These facings are dovetailed into the iron of the frame and the gate respectively.

The gate is of cast iron and consists essentially of a plate on the back of which are ribs to give the necessary strength and stiffness. Attached to a lug, on the center of the upper edge, is the operating stem, which is of bronze, four inches in diameter, and is raised or lowered by the operating machinery above.

The gate, as stated above, is furnished with a bronze facing or bearing surface, and in addition there are on each side, running the entire length, tongues or projections encased in bronze, which travel in corresponding bronze-lined grooves in the guides. This arrangement insures the smooth running of the gate and prevents it from being forced far away from its seat on the frame while being opened or closed, when the pressure on it is tending to force it away from the frame.

The pressure may be from either side, and it was therefore necessary to provide means of holding the gate securely against the frame when in the closed position, to prevent leakage under back pressure. To accomplish this purpose, adjustable wedges have been provided, four on each side of the gate and one on the bottom.

Extending through the entire length of the guides is the bronze-lined groove taking the tongue on the gate, all as described above. Each guide is made in two pieces spliced together at about the top of the frame, the upper portion of the guide being fastened directly to the masonry.

Each operating machine for the gates described above consists of an electric motor on the shaft of which is a worm. This turns a worm wheel, keyed to the inside of which is a bronze nut engaging the thread on the stem which is attached to the gate. Suitable ball bearings are provided to take the thrust of the worm and the resistances of the gate, and the whole machine is enclosed in a cast-iron case. This machine, the motor, and the limit switch which automatically stops the motor when the gate has arrived at the wide open or fully closed position are mounted on one bed-plate.

Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment are being constructed by Coleman Brothers, under Contract No. 44. This contract covers the portion of the work between the new Cambridge Bridge and a point some 300 feet west of the westerly line of Berkeley Street. At the close of the period covered by the last annual report, the conduit itself was completed from the Cambridge Bridge to Mt. Vernon Street, and during the month of December and until the middle of January concrete work was in progress on suitable days and was then suspended until about April 1. During the colder period, the work of smoothing the interior and repairing temperature cracks in the conduit was done, and at the same time the work of constructing the embankment with filling obtained by carts was carried on continually through the winter until the end of the year embraced within this report. In the spring concrete work was resumed. The first work of this kind was the building of the connection between the conduit and the sewer overflow at Otter Street. The plans for this overflow conduit were changed at the request of the Boston Transit Commission, so as to allow for the building of a subway beneath the conduit. For a distance of about 50 feet the elevation of the invert was raised and it was heavily reinforced with twisted steel rods. In June the conduit had been completed to the upper end of the section; the overflow chamber extending from the marginal conduit, through the embankment, to the river was completed in August; and the entire marginal conduit was completed on Oct. 5, 1908. The construction of the steps in the Basin wall and that portion of the wall adjacent

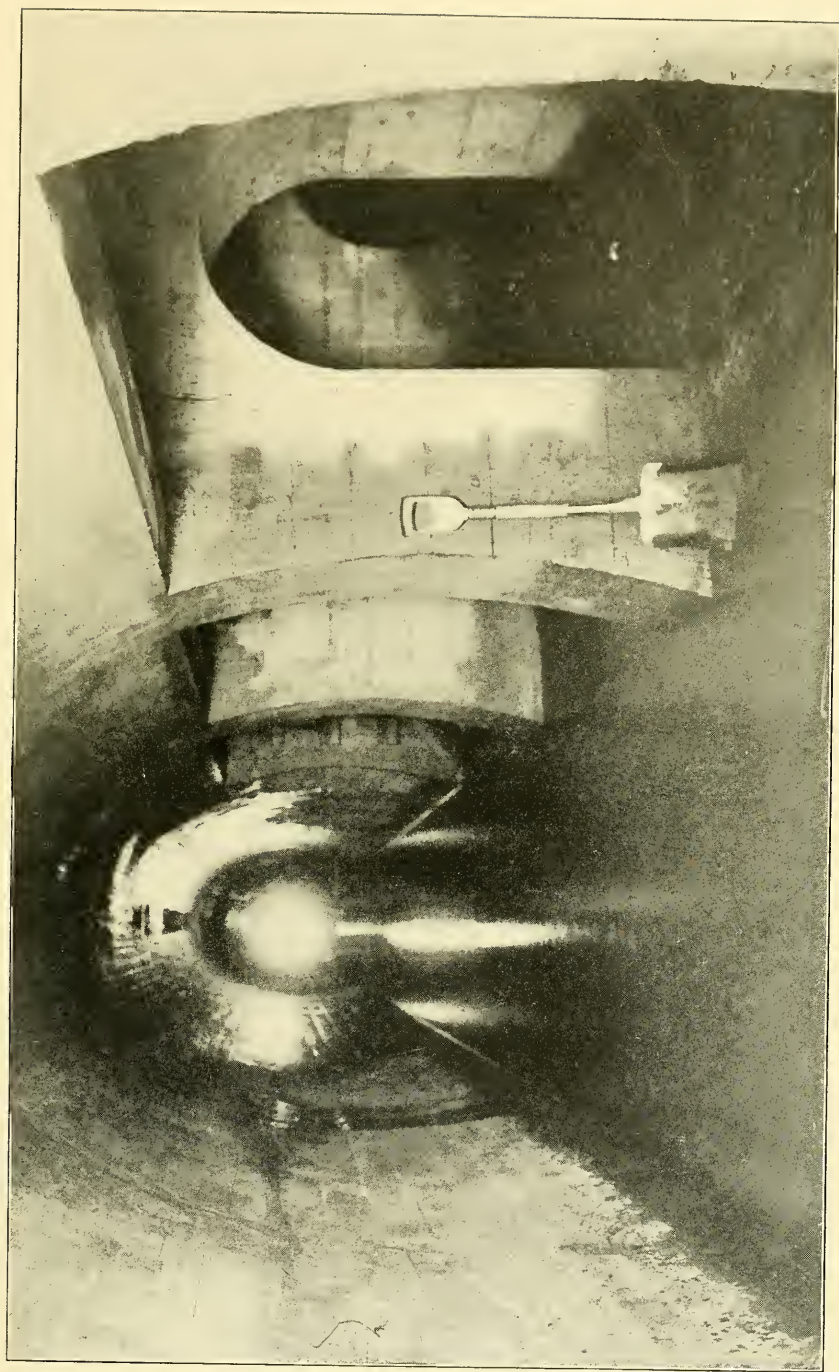
to the new Cambridge Bridge was commenced in December and completed in January. Beginning in April, the work of driving piles for the Basin wall at Berkeley Street was resumed, and the work of driving piles and building the masonry was continued during the remainder of the year. At the end of the year, all of the wall was completed so far as was practicable, with the exception of about 50 feet at points where the temporary outlets from the sewer overflows were still in use and also where openings were left to permit the construction of the submerged outlets described in another portion of this report. The embankment embraced under this contract was in process of construction all through the year, the larger portion of the material being delivered by carts, and at the end of the year the embankment was substantially completed to subgrade, except on the portion between Mt. Vernon and Otter streets, where some 6,000 or 7,000 cubic yards of material were still needed to complete it.

Sections 4 and 5 of the Boston Marginal Conduit and sections 2 and 3 of the Boston Embankment are being constructed by the Holbrook, Cabot & Rollins Corporation, under Contract No. 50. During the previous year only earth filling and pile-driving had been in progress. Early in December the masonry work was started, but was discontinued before the end of the month. During January, February and a part of March, piles were driven for the Basin wall and 4-inch tongued and grooved sheeting for the trench of the Boston Marginal Conduit. As fast as the sheeting for the conduit was driven and braced, earth filling was placed next the sheeting, either by a rehandler from the river or by a traveling machine operating a hydraulic orange peel bucket traveling on rails laid on caps fastened to the tops of the piles which supported the sheeting at the sides of the trench.

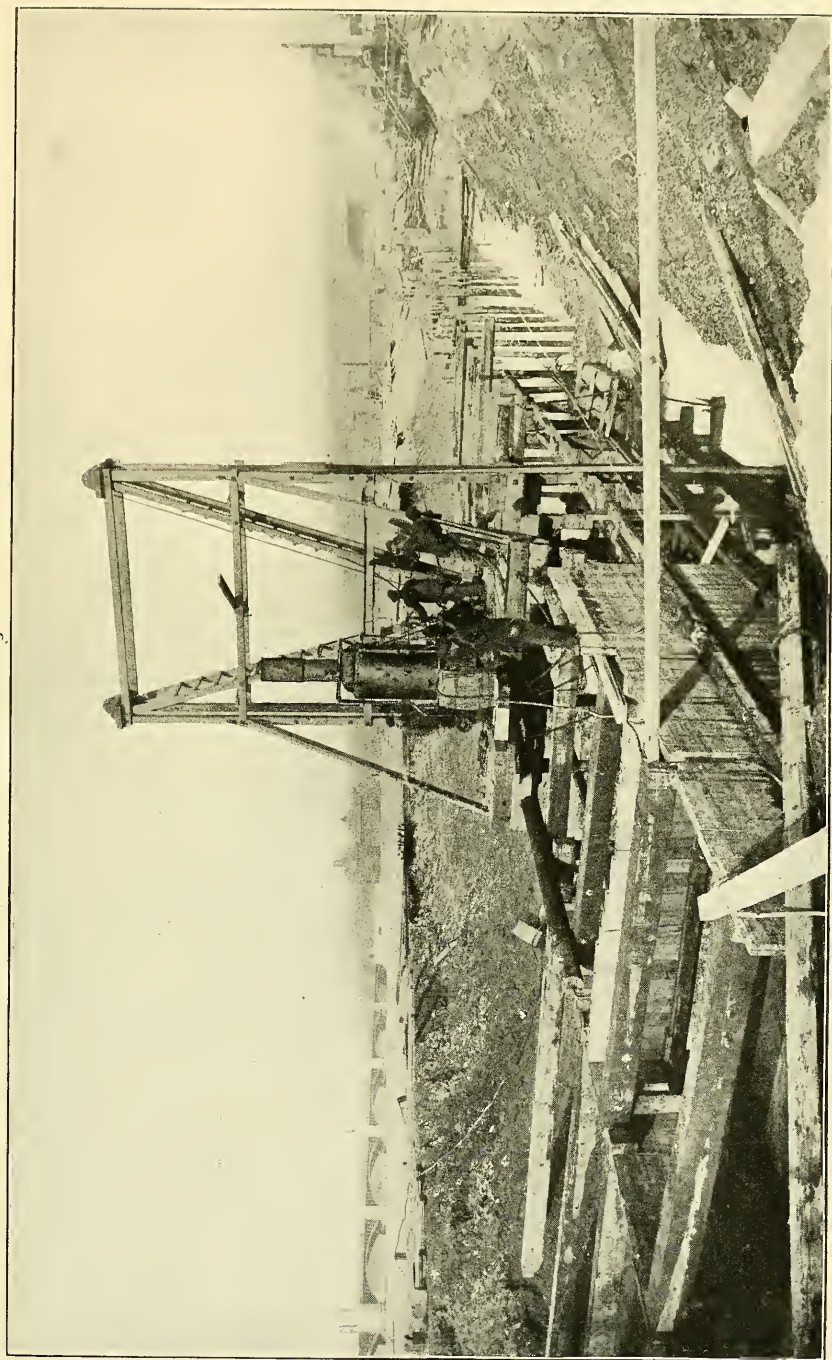
On these sections the contractor established two concrete plants, one between Dartmouth and Exeter streets, which was to furnish concrete for work extending about 1,200 feet each side of the mixing plant, and one just below Hereford Street, which should extend down-stream until it met the work constructed from Dartmouth Street and extending up-stream until

it met the work constructed under Contract No. 81. This latter portion was changed, however, and the portion above Harvard Bridge was put in from material brought by carts and mixed in a machine erected just above Harvard Bridge. At both the Dartmouth Street and the Hereford Street plants, however, the system of mixing was practically the same. The sand and gravel was brought in scows from Shirley Gut and dumped outside the line of the embankment opposite the mixing plant. From this dump it was raised by either a rehandler or a derrick to an elevated hopper, through which it passed over screens separating the gravel stones from the sand and depositing them in small storage bins. From the storage bins it passed into a measuring hopper, and from this hopper, after the addition of the proper amount of cement, the mixture was dumped into a small pit through which passed a bucket elevator which elevated the materials to a "Smith" concrete mixer, which was placed high enough so that the concrete could be dumped into a bucket placed on a car which was operated by an endless cable and run on a track placed on the fill adjacent to the sheet-piling. Ten-inch by 12-inch caps were placed on top of the piles supporting the sheet-piling and rails were laid on these caps, on which two travelers were placed. The first traveler was used in doing what additional excavation was necessary in the trench and in placing the forms for the side walls and arch. The second traveler was used in placing the concrete as it was brought out in buckets on the cars operated by a cable. In some cases the concrete for the foundation of the Basin wall was carried on at the same time as the concrete for the Boston Marginal Conduit; in other cases it was necessary to lay another track some 20 feet away from the Basin wall, and concrete was carried out on this track and handled into place on the Basin wall by a traveling derrick operated on the same track. When the filling had been sufficiently completed, the section of the trench below the Dartmouth Street mixer was pumped out and concrete work commenced. In the middle of the summer work was so far progressed that the other concrete plant was also put in operation.

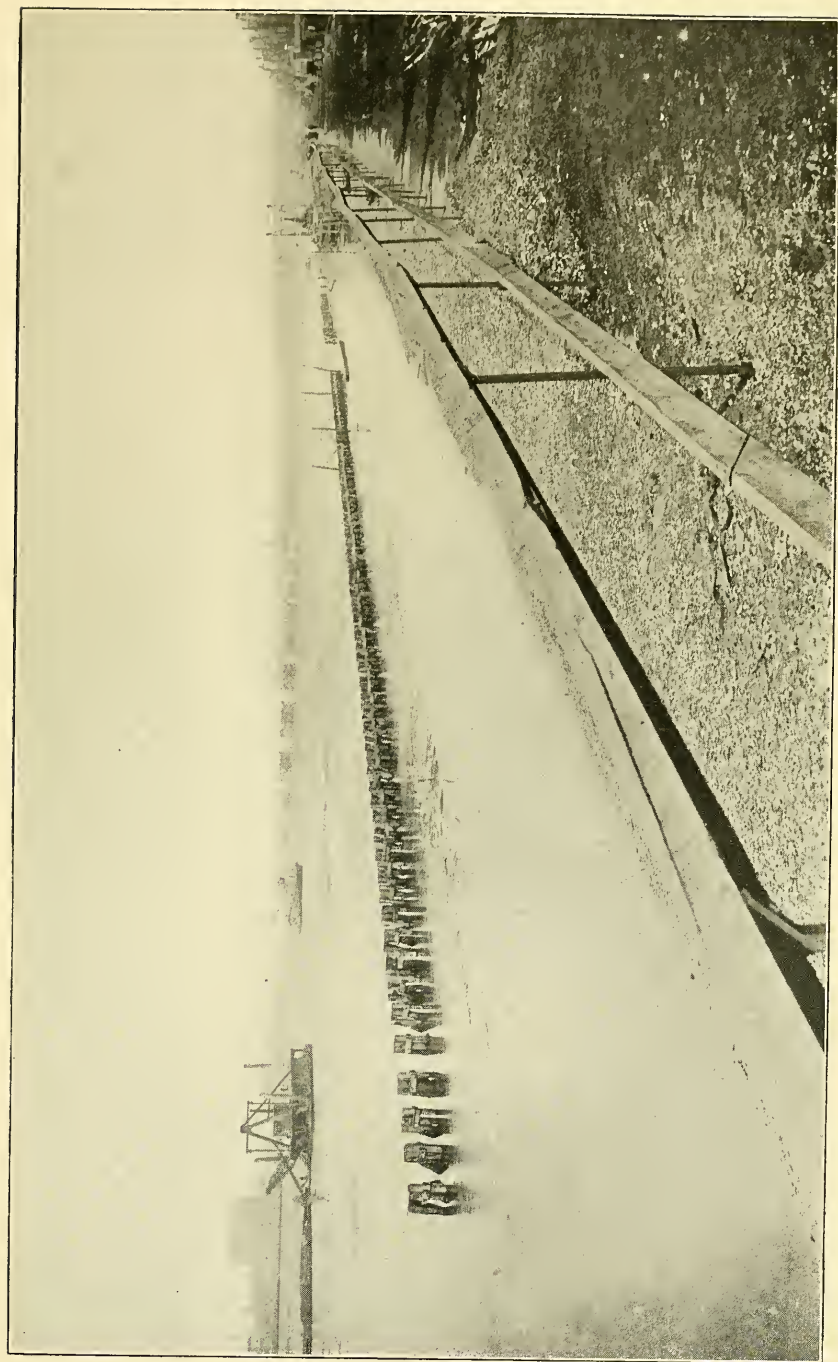
At Harvard Bridge it was necessary to remove a portion of the roadway about 20 feet in width and drive piles through the



BOSTON MARGINAL CONDUIT — CONNECTION WITH OVERFLOW CHAMBER.



BOSTON MARGINAL CONDUIT—SHEETED TRENCH NEAR CLARENDON STREET.



BOSTON EMBANKMENT — FOUNDATION PILES FOR WALL, NEAR HARVARD BRIDGE.

bridge for the foundation of the Boston Marginal Conduit. In two places above Harvard Bridge piles were omitted from the foundation of the Boston Marginal Conduit, as it was found impossible to drive piles with more than about 4 feet penetration. In these cases the concrete was carried down to hard bottom and allowed to set. After it had set, the invert rods were wired in place and the concrete of the regular section placed in the usual way. The Basin wall was not extended under the Harvard Bridge, as it was deemed desirable to leave the final determination of this portion of the embankment until such time as arrangements could be made between the City of Boston and the property owners for suitable connections between the bridge and Massachusetts Avenue and the embankment.

At the end of the year the conduit was entirely finished, the wall was entirely finished except the coping for about one-half of the wall, and the embankment was substantially completed for about three-fourths of its length.

Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment include the construction of the gate-chamber connecting the Stony Brook channels with the marginal conduit, a foot bridge over the outlet of the Fens Pond, and a short stretch of the marginal conduit to connect with the work being done by the Holbrook, Cabot & Rollins Corporation on Section 5. This contract was awarded to William H. Ellis, of Boston, the amount of the contract, based on the preliminary estimate of quantities, being \$74,700.50. This work required the building of three coffer-dams, the design and responsibility for which rested entirely with the contractor. The specifications provided only that the top of the coffer-dams should not be below elevation 115.

The two smaller coffer-dams were constructed and unwatered without difficulty. The largest coffer-dam, the one for the gate-chamber, was some 110 feet long by 70 feet wide, built of 4-inch tongued and grooved sheet-piling. On account of difficulty in driving the sheeting a sufficient distance into the hard material, the water found its way under the bottom of the sheeting at four different times, three of which occurred before any concrete was placed. The fourth and last one occurred after some three-fourths of the concrete bottom was in place and caused

the suspension of the work for about a week. These leaks were stopped by driving a line of 6-inch yellow pine splined sheet-piling outside of and bolted to the original spruce sheeting and then filling against the outside with solid material.

The gate-chamber to be built under this contract was located immediately in front of the then present outlets from Stony Brook, and before anything could be done on the gate-chamber it was necessary to build a temporary outlet from the two Stony Brook channels into the Fens Pond, controlled by tide-gates to prevent the tide-water from passing into the channels. The work of cutting into the side walls of the channels was first begun with hand drills, but so little progress was made that a steam drill was installed. Light charges of black powder were used without any injury to the conduits. The temporary outlet was entirely finished in the latter part of April. Afterwards bulkheads were built across the two channels to prevent water from entering the site of the gate-chamber. As soon as these bulkheads were completed the work on the gate-chamber was commenced. The hard material at the site of the gate-chamber was so near the grade of the bottom of the concrete that for a considerable portion of the area piles were omitted and the concrete carried down to hard material.

The coffer-dam for the Boston Marginal Conduit was the first one finished and pumped out. The concrete mixing plant used by the contractor was quite similar to the one used by the Holbrook, Cabot & Rollins Corporation on sections 4 and 5 of the Boston Marginal Conduit described above. Sand and gravel were dredged from the Charles River at Watertown and dumped from scows near the work, where they were raised by a derrick into an elevated hopper. During the progress of the work on the marginal conduit and gate-chamber, work on the Basin wall, on the bridge over the outlet of the Fens Pond and on the filling progressed as opportunity offered. The gate-chamber was substantially completed in September. Considerable delay and trouble were caused by not having suitable stone on hand for the Basin wall and the bridge, and a number of pieces of stone were rejected after delivery on account of poor material or workmanship.

The five submerged outlets of the overflows from the mar-

ginal conduit into the river were under construction during the year by Hiram W. Phillips, of Quincy, Mass. This work was started during the latter part of July. Four of the outlets, those at Pinckney, Berkeley, Fruit and Exeter streets, were in place at the end of the year, and work on the one at Gloucester Street had been started.

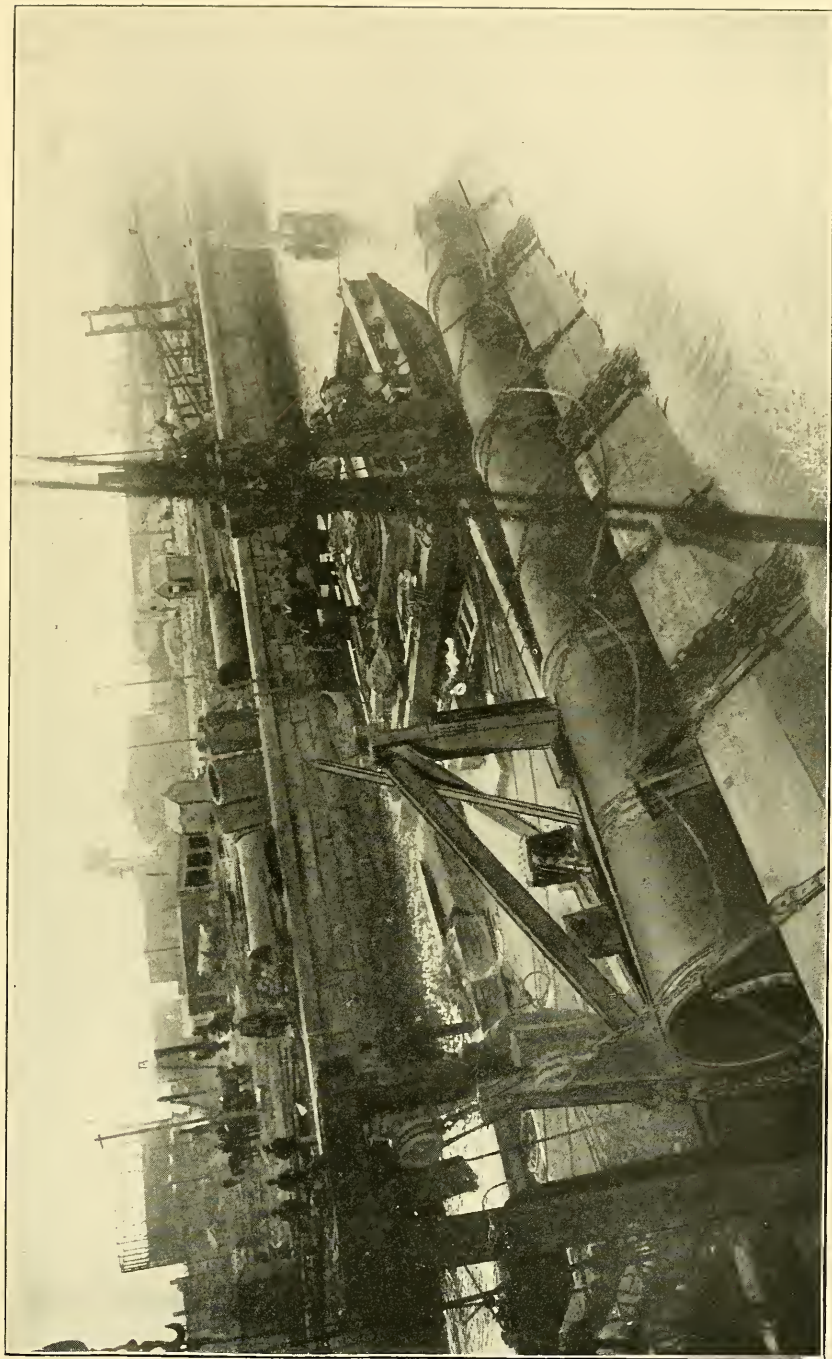
CAMBRIDGE MARGINAL CONDUIT.

At the commencement of the year the work of building the main portion of the Cambridge Marginal Conduit was in progress under Contract No. 70, Patrick McGovern, contractor. Very little work was done under this contract until the last of January, 1908, when a cableway was erected over the trench for the conduit on the south side of Lechmere Canal and east of Commercial Avenue. A pump-well was dug at the lower end of the section just outside the trench for the conduit, and a 6-inch centrifugal pump operated by an electric motor was installed. This pump and pump-well took care of all the water in the trench until within 100 feet of Binney Street, a distance of 1,200 linear feet. In making connections with the Binney Street sewer, it was necessary to excavate another pump-well and install another 6-inch pump. The concrete used on this work was mixed by a portable Ransome mixer. In order to make room for the connection of the new conduit with the sewer in Binney Street, a portion of the old 24-inch cast-iron pipe sewer in Commercial Avenue, some 125 feet in length, was taken up and a new 24-inch by 26-inch sewer with concrete invert and brick arch was built along the side of the new conduit. The work under this contract progressed without material delay through the spring and summer until its completion in July.

The inverted siphon for the Cambridge Marginal Conduit under Lechmere Canal, consisting of two 48-inch pipes, was in progress by Hiram W. Phillips, of Quincy, under Contract No. 76. At the end of the previous year the walls on each side of Lechmere Canal had been removed, the dredging approximately completed to the grade of the siphon, and sheeting driven on both sides of the trench on the south side of Lechmere Canal, where it passes through the old sea-wall. During December,

1907, and January and February, 1908, the rest of the dredging and pile-driving was completed, and the work of laying the 48-inch pipes was commenced in March, by the following method: Three lengths of pipe were placed together on a pontoon to which they were securely lashed with iron chains or wire cables, and after the joints were run and calked with lead in the usual manner, the pontoon was turned over so that the pipes were underneath the pontoon, and then floated into position. Then pontoon and pipes were lowered into place by admitting as much water into the pontoon as was necessary, when the pipes would be connected with the lengths already laid and the joint calked with "lead wool" by a diver. The pontoons were 52 feet long and 6 feet square, divided into compartments about 6 feet long, with valves for the admission of air or water as desired. The air was supplied from an air compressor located on a lighter, from which most of the work was done. The contract provided that the leakage in the pipe line should not exceed 5 gallons per hour per foot of pipe. A test of the westerly line showed a leakage of 0.28 gallon per hour per foot of pipe, and the easterly line showed a leakage of 1.06 gallons per hour per foot of pipe. After the pipes were tested, the trench was refilled over the pipes, the slopes ripped, and the wall on the south side of Lechmere Canal rebuilt.

Between the siphon chamber constructed by Patrick McGovern under Contract No. 70 and the portion of the Cambridge Marginal Conduit constructed by the Holbrook, Cabot & Rollins Corporation in connection with the Dam under Contract No. 1, there remained about 200 feet of the conduit not under contract, as there had been no opportunity to do this without interfering with the work in progress at the Dam. A contract was therefore made with Coleman Brothers for constructing this portion of the conduit, which was partly on filled land and partly in the river. It required the removal of a portion of an old sea-wall, of a timber wharf and of a stable before work could be commenced on the actual construction of the conduit, which was built in a sheeted trench and was practically completed at the end of the year.



CAMBRIDGE MARGINAL CONDUIT—LAYING 48-INCH PIPE SIPHON. PONTOON TURNING.

DREDGING AND PILE-DRIVING IN THE BASIN.

Dredging was in progress the greater part of the year, removing the earth portions of coffer-dams and dredging the required channels at both ends of the Lock and the sluices. Not counting the material excavated from the coffer-dams, some 18,000 cubic yards were dredged from the Basin under Contract No. 1, with the Holbrook, Cabot & Rollins Corporation.

BROAD AND LECHMERE CANALS.

The work of dredging these canals was continued at intervals during the year. Some 8,000 cubic yards were dredged from Broad Canal and some 41,000 cubic yards from Lechmere Canal. This work was done by the Holbrook, Cabot & Rollins Corporation under Contract No. 1.

Work was also done by the same contractor, under Contract No. 23, driving and capping piles in Lechmere Canal in the dock between Sawyer's lumber yard and the Davenport-Peters property and in Broad Canal in front of the Tower property and in front of that portion of the property of the Geo. G. Page Box Company above the railroad bridge.

In accordance with chapter 633 of the Acts of 1908, requiring the Charles River Basin Commission to reconstruct the wall in front of the property owned and leased by the Bay State Fuel Company on Broad Canal, Contract No. 106 was made with William L. Miller, of Boston, to do the work required under the Act. The buildings of the Bay State Fuel Company were supported and the old wall removed, together with the oak piles in front of it, and the new wall constructed and the oak piles redriven. This work was pushed with energy, and at the end of the period covered by this report was entirely completed.

PLAN FOR LAND TAKING.

For the right to construct an approach from Charles Street to the Boston Embankment, a taking plan was made of land of the Massachusetts Charitable Eye and Ear Infirmary east of and adjoining the Charles River, a short distance south of the new Cambridge Bridge.

UPLAND FLOW OF THE CHARLES RIVER.

A recording gage, showing the depth of water flowing over the dam at the Waltham Bleachery, was maintained, and weekly current meter observations were taken of the flow in the canal past the Bleachery Dam.

Table No. 1 shows the estimated average flow of the Charles River at the Waltham Bleachery for weekly periods during the year ending Nov. 30, 1908. The area of the watershed above the Waltham Bleachery is taken to be 169 square miles; this excludes 70 square miles assumed to be tributary to Mother Brook and 24 square miles tributary to the Cambridge reservoirs. Whenever these reservoirs overflowed into the Charles, the amount, as furnished by Mr. L. M. Hastings, city engineer of Cambridge, has been deducted from the total discharge measured at the Waltham Bleachery.

Table No. 2 shows the number of days during the year ending Nov. 30, 1908, when the upland flow of the Charles River at the site of the Dam, estimated from the records kept by the Charles River Basin Commission at the Waltham Bleachery, was more than 500 cubic feet per second for twenty-four hours.

Table No. 3 shows the length of time during which the water in the Harbor under normal tide conditions will be higher than the water in the Basin, and the rise of the Basin during that interval for various rates of upland flow.

Diagram No. 1 shows the daily flow of the Charles River at the Waltham Bleachery during the year ending Nov. 30, 1908, in connection with the rainfall at Chestnut Hill, taken from the records of the Metropolitan Water Works.

TABLE No. 1. — *Estimated Weekly Average Flow of Charles River at the Waltham Bleachery for the Year ending Nov. 30, 1908.*

WEEK ENDING —	Cubic Feet per Second.	Cubic Feet per Second per Square Mile. ¹	WEEK ENDING —	Cubic Feet per Second.	Cubic Feet per Second per Square Mile. ¹
1907.			1908.		
Dec. 7, . .	429	2.54	June 6, . .	202	1.20
14, . .	346	2.05	13, . .	160	0.95
21, . .	335	1.98	20, . .	78	0.46
28, . .	435	2.57	27, . .	37	0.22
1908.			July 4, . .	27	0.16
Jan. 4, . .	590	3.49	11, . .	18	0.11
11, . .	475	2.81	18, . .	19	0.11
18, . .	520	3.08	25, . .	31	0.18
25, . .	371	2.20	Aug. 1, . .	66	0.39
Feb. 1, . .	322	1.91	8, . .	61	0.36
8, . .	291	1.72	15, . .	91	0.54
15, . .	201	1.19	22, . .	87	0.51
22, . .	429	2.54	29, . .	31	0.18
29, . .	447	2.64	Sept. 5, . .	47	0.28
Mar. 7, . .	476	2.82	12, . .	60	0.36
14, . .	436	2.58	19, . .	13	0.08
21, . .	450	2.66	26, . .	9	0.05
28, . .	505	2.99	Oct. 3, . .	19	0.11
Apr. 4, . .	379	2.24	10, . .	31	0.18
11, . .	392	2.32	17, . .	24	0.14
18, . .	324	1.92	24, . .	33	0.20
25, . .	242	1.43	31, . .	56	0.33
May 2, . .	225	1.33	Nov. 7, . .	68	0.40
9, . .	188	1.11	14, . .	43	0.25
16, . .	217	1.28	21, . .	48	0.28
23, . .	197	1.17	28, . .	61	0.36
30, . .	158	0.93	Dec. 5, . .	39	0.23

¹ Area of watershed is 169 square miles.

TABLE NO. 2. — *Number of Days during Year ending Nov. 30, 1908, when Estimated Upland Flow of Charles River at the Site of the Dam was more than 500 Cubic Feet per Second for Twenty-four Hours, from Records kept by the Charles River Basin Commission at the Waltham Bleachery.*

MONTH.	500-749 Cubic Feet per Second (Days).	750-999 Cubic Feet per Second (Days).	1,000-1,499 Cubic Feet per Second (Days).	1,500-1,999 Cubic Feet per Second (Days).	2,000-2,499 Cubic Feet per Second (Days).	Total Number of Days exceeding 500 Cubic Feet per Second.	Rainfall at Chestnut Hill (Inches).	Average Rainfall on Sudbury Watershed for Thirty-three Years (Inches).
1907.								
December, . . .	12	2	-	-	-	14	6.25	4.16
1908.								
January, . . .	20	4	-	-	-	24	4.50	4.17
February, . . .	15	-	-	-	-	15	6.22	4.52
March, . . .	29	1	-	-	-	30	4.18	3.55
April, . . .	7	-	-	-	-	7	2.64	3.36
May, . . .	-	-	-	-	-	-	4.56	3.18
June, . . .	-	-	-	-	-	-	1.28	3.66
July, . . .	-	-	-	-	-	-	4.18	3.89
August, . . .	-	-	-	-	-	-	5.56	3.59
September, . . .	-	-	-	-	-	-	1.22	4.12
October, . . .	-	-	-	-	-	-	4.34	3.93
November, . . .	-	-	-	-	-	-	1.17	3.86
Totals, . . .	83	7	-	-	-	90	46.10	45.99
1906-07, ¹ . . .	54	14	-	-	-	68	50.94	-
1905-06, ² . . .	29	26	-	-	-	55	50.11	-
1904-05, ¹ . . .	21	25	5	-	-	51	39.10	-
1903-04, ¹ . . .	29	18	13	5	1	66	45.98	-

¹ 1 year.² 14 months.

The estimated flow at the site of the Dam was obtained from that at the Waltham Bleachery by applying the yield per square mile given in Table No. 1 and adding the waste from the Cambridge reservoirs watershed as obtained from the records kept by the City of Cambridge.

TABLE NO. 3. — *Time during which the Water in the Harbor under Normal Tide Conditions will be Above the Water in the Basin, and Rise of Basin during that Interval for Various Rates of Upland Flow.*

Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).	Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).
	Hrs.	Min.			Hrs.	Min.	
500	3	48	.20	3,000	3	19	1.02
1,000	3	42	.39	4,000	3	8	1.28
1,500	3	36	.56	5,000	2	58	1.51
2,000	3	30	.72	6,000	2	49	1.71
2,500	3	25	.87	—	—	—	—

TRAFFIC THROUGH DRAW OF CRAIGIE BRIDGE AND OF TEMPORARY BRIDGE.

A record has been kept of the traffic through the draw of the temporary bridge. This record gives the tonnage, draft and time of passage of vessels of different kinds. Some of the results of the records obtained are shown by the following diagrams: —

Diagram No. 2 shows weekly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through the temporary bridge for the year ending Nov. 30, 1908.

Diagram No. 3 shows the monthly totals of cargoes, in tons, not including the material furnished for the Charles River Dam, passing through Craigie Bridge or the temporary bridge since Nov. 30, 1899.

Diagram No. 4 shows the yearly number of vessels passing through Craigie Bridge or the temporary bridge since Sept. 30, 1885, and the number of times the draw has been opened per year since Sept. 30, 1871, the only complete years covered by existing records.

MISCELLANEOUS ENGINEERING WORK.

Two hundred and fifty-six finished plans were made during the year, in addition to a large number of studies and sketches. Two hundred and seventy-three plans were indexed and filed,

which, with the plans previously filed, make a total of 1,168 plans.

One hundred and fifty-five photographs were taken by Mr. Luther H. Shattuck.

Observations were taken of the elevation to which sewer overflows rise at times of high water.

The drains of various kinds entering the Basin and the Cambridge canals have been surveyed and records made, and the usual miscellaneous work of soundings and surveys was done.

CONTRACTS.

Twenty-nine contracts were made during the year. The preparation of the various contract plans, specifications and estimates, supervision of the construction work, etc., occupied the greater portion of the time of the engineering force. A detailed statement of the contracts made and pending during the year is given in Appendix B.

Following are additional descriptions of some of these contracts, except so far as the work done under them has already been described under the headings of "Dam and Lock," "Boston Marginal Conduit and Boston Embankment," "Cambridge Marginal Conduit," "Dredging and Pile-driving in the Basin" and "Broad and Lechmere Canals."

Contract No. 1, Holbrook, Cabot & Rollins Corporation. — Dam and Lock in the Charles River, Boston and Cambridge.

On Jan. 14, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for the construction of the Dam and Lock. A general description of the work to be done under this contract is given in the report for the year ending Sept. 30, 1905.

The following is a summary of the work of the current year: —

During the first week in March the sump holes in the bottom of the Lock were filled with concrete, and on March 10 the contractor began removing his pumps from the Boston coffer-dam, and the water was allowed to rise against the stop-planks at the ends of the Lock.

On March 17 dredging was started for the rest pier on the easterly side of the approach to the Lock. Pile-driving was started on May 18 and continued until July 7, when the piles were completed. Gravel and riprap were being placed on the slope under the rest pier from July 8 to July 28, when the work of placing concrete and stone masonry was started, continuing until August 17.

On April 3 dredging was commenced on the northeast corner of the Cambridge coffer-dam, and excavation was started for extending the Cambridge Marginal Conduit within the limits of the coffer-dam. This portion of the marginal conduit and the support for the steps were finished April 23.

The excavation for the connection of the Bridge Street sewer was started May 13.

During the summer the dredging and pulling of the sheet-piling for the removal of the coffer-dam above and below the sluices were in progress.

The driving of piles for the shut-off dam was started early in March, the first piece of sheeting was driven on April 6, and from that time on work was continuous on this structure, except from April 13 to May 16. On the morning of October 2, when the predicted tides had a range of about 8 feet, two pile-drivers and two lighters began the work of driving the last 100 feet of sheeting in the shut-off dam, at 8 o'clock, about one hour before low water, and the entire 100 feet of sheeting was driven by 10 A.M. On the morning of October 20, at 11 o'clock, at a pre-arranged signal, the gates were dropped and the work of placing earth on each side of the shut-off dam commenced.

The total value of the work performed, as shown by the November, 1908, estimate, was \$776,236.02, the principal items of which were as follows: —

Coffer-dam at the Boston end,	98 per cent. completed. ¹
Coffer-dam at the Cambridge end,	98 per cent. completed. ¹
Earth excavation,	526,690 cu. yds.
Coarse gravel in place,	6,100 cu. yds.
Broken stone or screened gravel in place, not otherwise paid for,	800 cu. yds.
Riprap in place,	8,500 tons.

¹ Assumed not completed until removed.

Round piles in place (exclusive of coffer-dams),	385,400 lin. ft.
Long-leaf yellow pine lumber in place,	300 M. ft. B. M.
Spruce lumber in place,	331.14 M. ft. B. M.
Wrought iron and steel in place in shut-off dam,	50,000 lbs.
Concrete masonry,	38,020 cu. yds.
Granolithic surfacing,	1,240 sq. yds.
Ashlar masonry,	700 cu. yds.
Dimension stone masonry,	140 cu. yds.
Face dressing,	7,600 sq. ft.
Iron and other metal work placed,	735 tons.
Special work,	\$17,844.05
Extra work,	108,399.77

Contract No. 5, Henry R. Worthington. — Furnishing and erecting Pumps, Boston and Cambridge.

On Sept. 30, 1905, a contract was made with Henry R. Worthington for furnishing and erecting pumps. A description of the work called for under this contract is given in the report for the year ending Sept. 30, 1905.

Preliminary tests on these pumps were made during the year, but they were found not to be up to the required capacity, and the contractor arranged to make changes to increase their efficiency.

The total amount paid to the end of the year was \$9,326.40.

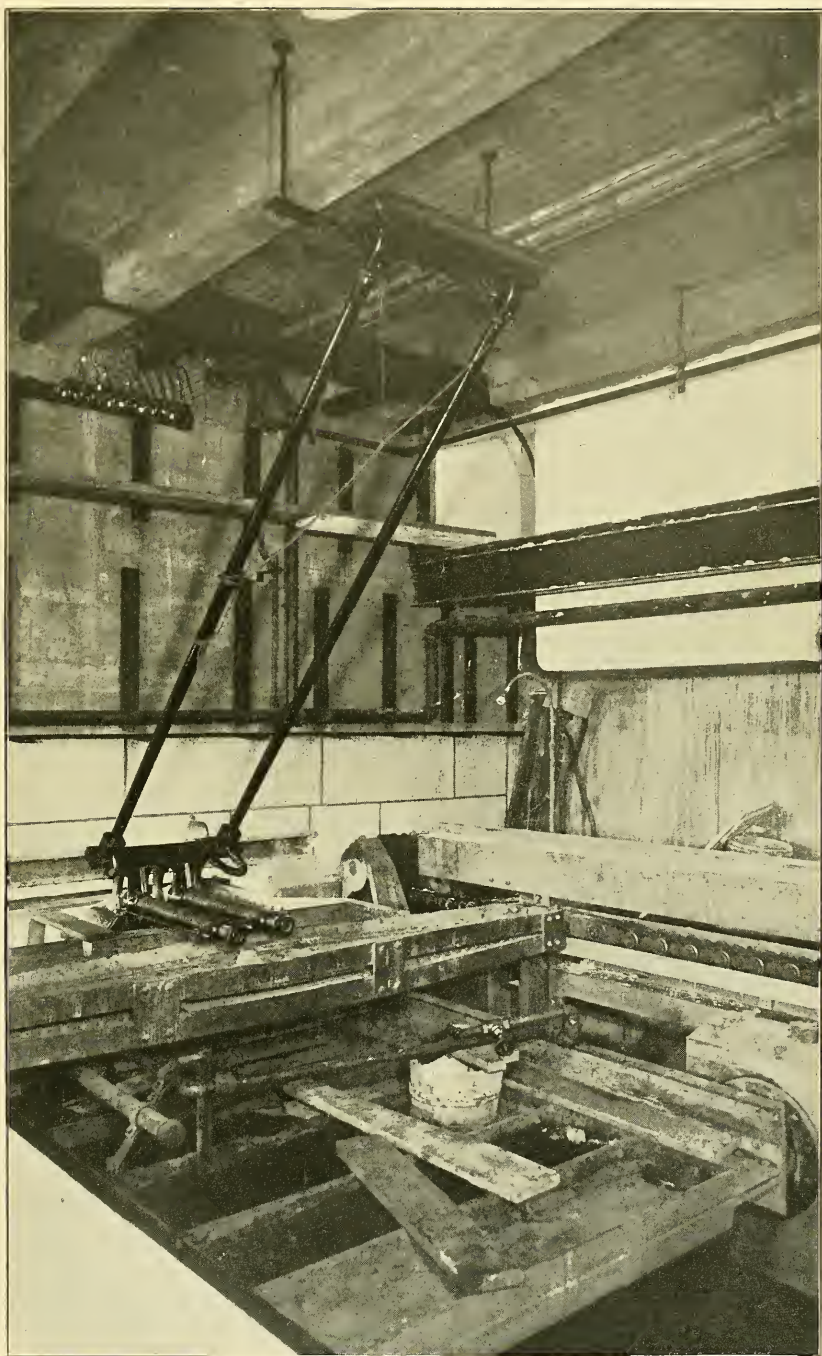
Contract No. 23, Holbrook, Cabot & Rollins Corporation. — Furnishing, driving and capping Piles, Cambridge.

On Dec. 4, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for piles along the walls of the canals and Basin in Cambridge.

Work on this contract was completed February 21, and the final estimate, calling for a total of \$82,063.73, was made March 2, 1908.

Contract No. 24, American Bridge Company of New York. — Constructing a Scherzer Rolling Lift Bridge, Boston.

On March 16, 1906, a contract was made with the American Bridge Company of New York for a Scherzer rolling lift bridge across the down-stream end of the Lock.



LOCK—TROLLEY ON GATE FOR SUPPLYING POWER TO LOCK FILLING GATES.

This bridge was substantially completed during the year covered by the last annual report.

During December and January plans were made for a satisfactory method of hanging the motors, and these supports were in place before the end of January.

The down-stream leaf was raised for the first time on January 25 and the up-stream leaf two days later. In February the remainder of the counterweight was placed. During the following month each leaf was adjusted and tested, and the railing and fasciæ erected and painted.

The final estimate, calling for \$40,814.42, was made April 7, 1908.

Contract No. 25, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices in the Dam, Cambridge.

On March 16, 1906, a contract was made with the Coffin Valve Company for the large gates for the sluices, for the sum of \$24,800.

The work during the year consisted mainly of installing the permanent electrical control, and the gates were sufficiently completed so that they could be operated in August, but tests and adjustments had not been completed at the end of the year.

The total amount paid to the end of the year was \$21,080.

Contract No. 27, Coffin Valve Company. — Furnishing Sluice-gates on the Lock-gates in the Lock, Boston.

On March 6, 1906, a contract was made with the Coffin Valve Company for furnishing the sluice-gates on the lock-gates at the Lock, for the sum of \$17,093.

The erection of the fourteen filling gates on the lock-gates was in progress during the winter.

The placing of the motors and cut-outs, together with the wiring necessary for the temporary operation of the gate until the lower lock-gate house was built, was under way during the summer.

After the completion of the shut-off dam, Oct. 20, 1908, the gates went into service immediately, and it was noticed that it was taking more power to operate the motors than they were designed for. Accordingly, the gearing in the motors has been

changed, reducing the speed and increasing the length of time required for operation.

The value of the work done, as shown by the October, 1908, estimate, was \$15,893, and no additional material was delivered between the date of that estimate and the end of the year.

Contract No. 28, Coffin Valve Company. — Furnishing Tide-gates at the Dam and Lock, Boston and Cambridge.

On March 16, 1906, a contract was made with the Coffin Valve Company for furnishing and erecting twenty-five tide-gates at the Dam and Lock, the contract price for the gates being \$4,438.

These twenty-five gates had been erected during the previous year, but were not tested until the coffer-dams were removed. As soon as possible, tests were made on the different tide-gates. It was found in all cases, except those with counterweights on brackets, that there was not sufficient weight on the flaps to overcome their buoyancy, probably due to the two coats of Cabot's Conservo with which they had been painted as a protection, and additional weights have been bolted to the flaps in such a way that they can easily be removed in case the wood absorbs enough water to make the weights unnecessary. In several cases it was found that there was not enough clearance around the composition rods holding the slats together to give sufficient play to the separate slats, and the holes through which the rods passed have been made from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch larger in diameter with good results.

The final estimate under this contract, amounting to \$4,438, was made Dec. 16, 1907.

Contract No. 30, New Jersey-West Virginia Bridge Company. — Constructing Lock-gates, Boston.

On June 13, 1906, a contract was made with the New Jersey-West Virginia Bridge Company for the construction of the rolling lock-gates in the Lock, the price to be \$26,784.

During December, 1907, the work of riveting was in progress on both gates, and was practically completed by the end of the month.

The work of calking the edges of the plates in order to make the joints tight under both air and water pressure was started

on Dec. 19, 1907, and continued through January and February, 1908, when work was suspended until warmer weather, at which time tests could be made.

On April 2, 1908, the work of testing compartments in the lower gate was started, and during the months of April and May the testing and recalking of the seams of the compartments in both gates was in progress, and the entire work under this contract was completed May 28, 1908.

The final estimate, amounting to \$27,971.38, was made June 5, 1908, but owing to differences among different parties claiming to have an interest in the contract, the balance of \$2,841.40 found due them under the estimate had not been paid at the end of the year.

Contract No. 37, American Ship Windlass Company. — Furnishing and erecting Electric Dock Capstans at Lock, Boston.

On May 24, 1906, a contract was made with the American Ship Windlass Company for two capstans for warping vessels through the Lock, for the sum of \$2,100.

This contract was completed during the previous year, and the final estimate, amounting to \$2,100, was made Dec. 23, 1907.

Contract No. 41, Coffin Valve Company. — Furnishing Sluice-gates at the Sluices and Boston Marginal Conduit, Cambridge and Boston.

On June 14, 1906, a contract was made with the Coffin Valve Company for six sluice-gates at the Dam and Lock, for the sum of \$11,862.

Work on this contract during the year consisted of delivering and erecting a portion of the operating machinery and the electrical controlling devices.

The two hand-operated gates called for under this contract had not been tested under contract conditions and therefore had not been accepted at the end of the year.

The 8-foot by 8-foot gate had been operated by its motor, and the indicating device had been installed.

The other three gates had all been operated with the electric motors but had not been tested under contract requirements at the end of the year.

The value of the work done, as shown by the October, 1908, estimate, was \$11,652, and no additional material was delivered between the date of that estimate and the end of the year.

Contract No. 44, Coleman Brothers. — Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment, Boston.

On Sept. 24, 1906, a contract was made with Coleman Brothers for this work, extending from the new Cambridge Bridge to a point 300 feet above Berkeley Street.

The work of filling was continued without much interruption during the year, the larger portion of the material being delivered by carts. At the end of the year the embankment was substantially completed to subgrade, except on the area between Mt. Vernon and Otter streets, where some 6,000 or 7,000 cubic yards of filling were still required.

The work of placing concrete in the Boston Marginal Conduit was continued on suitable days until January 18, when it was suspended until March 25. Meanwhile, the work of smoothing the interior and calking temperature cracks was conducted.

On March 25 concrete work on the conduit was resumed near Otter Street.

Early in June excavation was made through the embankment near Berkeley Street, bringing the work to a connection with the work being done on Section 2.

The construction of the overflow chamber near Berkeley Street was finished on August 8, and the entire conduit was completed on October 5.

The construction of the steps and special work on the Basin wall near the new Cambridge Bridge was finished on Jan. 8, 1908.

At the end of the year the Basin wall was completed, except for openings left where the temporary outlets from the sewer overflows pass through the wall.

The total value of the work done, as shown by the November, 1908, estimate, was \$316,419.27, the principal items of which were as follows: —

Earth excavation and refill,	165 lin. ft.
Earth filling,	516,618 cu. yds.
Piles in place,	204,892 lin. ft.
Drains,	3,576 lin. ft.
Concrete masonry,	6,824 cu. yds.
Ashlar masonry,	871 cu. yds.
Face dressing of pointed work,	13,027 sq. ft.
Sheeting left in place,	504.4 M. ft. B. M.
Yellow pine lumber in place in sewer outlets,	76.5 M. ft. B. M.
Wrought iron and steel in place in sewer outlets,	22,906 pounds.
Iron and other metal work placed,	106 tons.
Extra work,	\$6,488.52

Contract No. 48, The Lumsden & Van Stone Company. — Furnishing and erecting Steam, Water and Air Piping, Boston.

On Oct. 20, 1906, a contract for this work was made with The Lumsden & Van Stone Company for \$2,098.

This contract covered the furnishing and erecting of a system of radiators and piping for heating both of the lock-gates during extreme cold weather to prevent the formation of ice upon the outside. It also included a system of air piping whereby any closed compartment of the gate might be emptied of water and by which it would be possible to examine the lock-gate trucks or tracks by sending a man down under air pressure, the compartment around the trucks acting as a diving bell.

The work of erecting this contract was finished in the spring of 1908, but the final estimate, amounting to \$2,102, was not made until November 16, as the contractor preferred to delay the testing of the work until he could procure steam from the boiler plant.

Contract No. 50, Holbrook, Cabot & Rollins Corporation. — Sections 4 and 5 of the Boston Marginal Conduit and Sections 2 and 3 of the Boston Embankment, Boston.

On Nov. 5, 1906, a contract was made with the Holbrook, Cabot & Rollins Corporation for constructing Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment.

On April 3, 1907, an agreement was made with the contractor to extend this contract 2,000 feet farther up the river, the prices to be the same as on the original contract.

Beginning Dec. 2, 1907, the work of building the concrete connection between the Boston Marginal Conduit and the sewer overflow at Dartmouth Street was started. On December 27 the concrete masonry had been built to within about 10 feet of the marginal conduit, when work was suspended on account of cold weather.

During January, February and a part of March the work of driving piles for the Basin wall and 4-inch tongued and grooved sheet-piling for the trench of the Boston Marginal Conduit was in progress.

On March 26 the pumping out of the first section of the Boston Marginal Conduit trench was started below Dartmouth Street.

The first batch of concrete for the Boston Marginal Conduit was placed April 13. On July 22 the second concrete mixer, at Hereford Street, was started. The two concrete mixing plants were in operation most of the time until the completion of the conduit, on October 20.

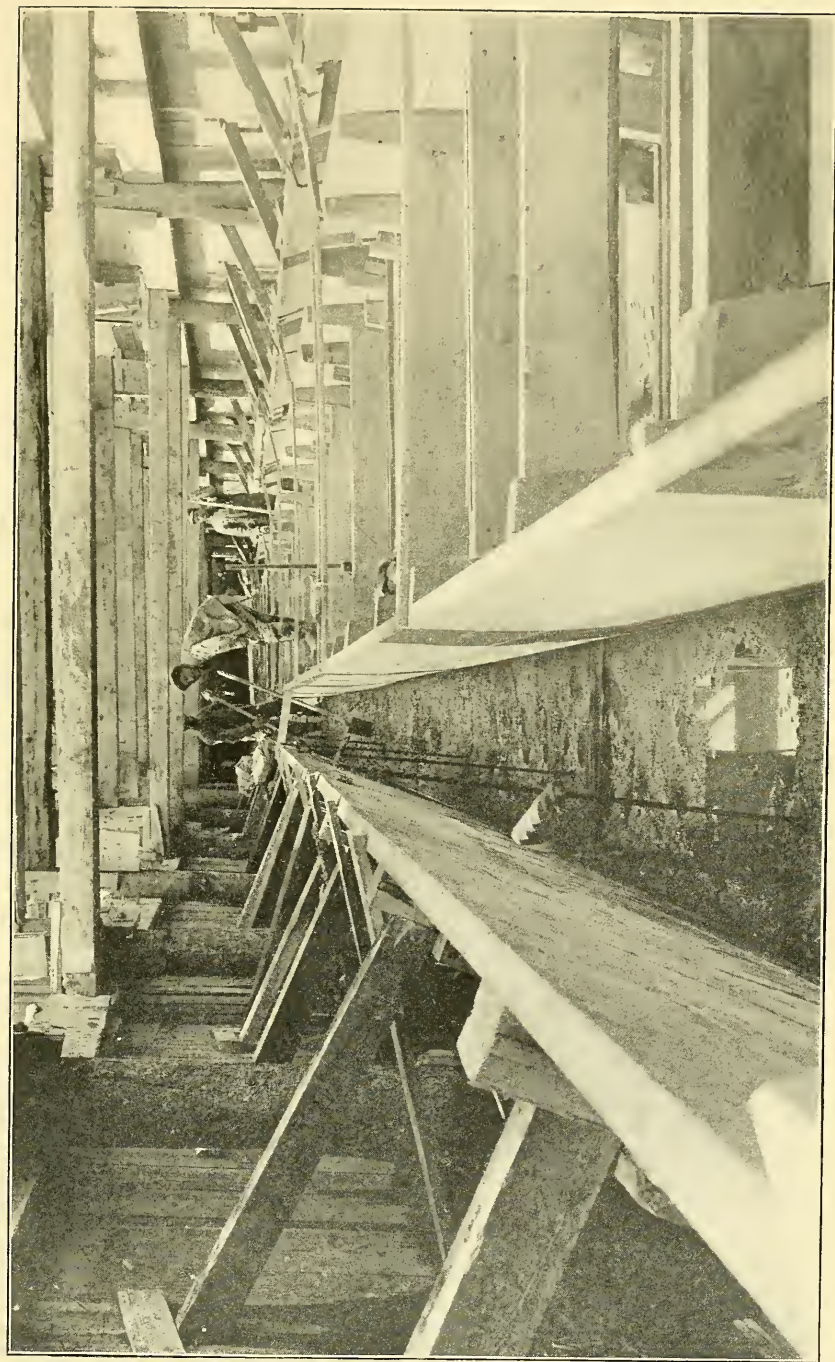
The total value of the work done, as shown by the November, 1908, estimate, was \$334,293.48, the principal items of which were as follows:—

Earth filling,	254,102 cu. yds.
Piles in place,	222,329 lin. ft.
Drains,	4,600 lin. ft.
Concrete masonry,	10,204 cu. yds.
Ashlar masonry,	895.4 cu. yds.
Face dressing of pointed work,	6,775 sq. ft.
Yellow pine lumber in place in temporary sewer out-lets,	28 M. ft. B. M.
Iron and other metal work placed,	98.8 tons.
Extra work,	\$22,677.33

Contract No. 51, Lynch & Woodward. — Furnishing and erecting a Boiler Plant, Boston.

On Dec. 4, 1906, a contract was made with Lynch & Woodward for the erection of a boiler plant at the Lock, the amount of the contract being \$2,164.

This contract was for furnishing and erecting two horizontal return tubular boilers, each 48 inches in diameter and with a



BOSTON MARGINAL CONDUIT—SIDE WALL FORMS BELOW DARTMOUTH STREET.

heating surface of about 755 square feet, together with the up-takes, dampers, flue and miscellaneous fittings and tools.

This contract was completed and the plant in operation at the close of the year. The completion of the contract was delayed owing to the fact that the flue could not be erected until the erection of the lower lock-gate house had advanced considerably.

The final estimate, amounting to \$2,175.78, was made Nov. 23, 1908.

Contract No. 57, William H. Wood & Co. — Furnishing Spruce Lumber for repairing Temporary Bridge.

On Feb. 4, 1907, a contract was made with William H. Wood & Company for the lumber required for repairing the temporary bridge to Jan. 1, 1908, at a price of \$21 per M. ft. B. M. for both 2-inch and 3-inch plank.

The contractor continued to furnish material under this contract until the contract was completed, on Jan. 23, 1908.

A voucher for the final payment on this contract was approved Feb. 25, 1908, making a total payment of \$3,501.68.

Contract No. 59, The Lockwood Manufacturing Company. — Furnishing and erecting a Timber Ice-run Sluice-gate, Boston.

On June 3, 1907, a contract was made with The Lockwood Manufacturing Company for the timber ice-run gate for the upper lock-gate, the contract price being \$847.

This gate is designed to be used as a weir for regulating the flow of water through the upper lock-gate when ice cakes are being run through the ice-run gate. It is made of yellow pine 9½ inches thick, and is 3 feet 3 inches high by 14 feet 6 inches long. The timbers at the ends frame into iron castings which are threaded to receive bronze screw stems, one at each end, which are extended through the top of the lock-gate, where each is furnished with a square nut. These stems are operated by hand with socket wrenches, and the gate is thus raised or lowered to the desired position.

The final estimate on this contract, amounting to \$847, was made Feb. 25, 1908.

Contract No. 60, Link-Belt Company. — Furnishing Lock-gate Operating Machinery, Boston.

On April 23, 1907, a contract was made with the Link-Belt Company for the operating machinery for the lock-gates at the Lock, the contract price being \$10,000.

This contract is for the machinery for operating the lock-gates. Two 50 H. P., railway type, electric motors, furnished by the Westinghouse Electric Manufacturing Company under another contract, drive a shaft on the end of which is a spur gear driving an intermediate shaft, which in turn drives a main shaft extending across the rear end (or that end farthest from the Lock) of the lock-gate recess. At either end of this shaft is mounted a sprocket. Over each sprocket passes a chain which is connected to an equalizer beam or whiffle-tree connected to the lock-gate. At the opposite end of the lock-gate recess (or that end adjacent to the Lock) are mounted in suitable bearings two sprockets, over which these chains, which are endless, pass. According to the direction of the rotation of the motors, the lock-gate is thereby moved across the Lock, or closed, or is withdrawn into the lock-gate recess, thereby opening it. The contract included the chains, sprockets, shafting, shaft bearings, and all the gears with the exception of the first reduction gears, which were furnished with the motors.

The contract was completed, and the final estimate, amounting to \$10,030.05, was made May 15, 1908.

Contract No. 63, Baltimore Bridge Company. — Furnishing Lock-gate Operating Chain Supports, Boston.

On May 9, 1907, a contract was made with the Baltimore Bridge Company for the lock-gate operating chain supports. The full amount of the contract, including some additional material, was \$5,143.

All the material was delivered during the previous year, but the final estimate was held until the completion of the erection of the work, to ascertain if the parts would go together as intended.

The final estimate, amounting to \$5,143, was made June 15, 1908.

*Contract No. 66, The Cutler-Hammer Manufacturing Company.
— Furnishing Controlling Devices for Operating Motors of
Main Lock-gates, Boston.*

On May 22, 1907, a contract was made with The Cutler-Hammer Manufacturing Company for furnishing the electrical control for operating the motors for the main lock-gates, the amount being \$2,958.

This contract included the furnishing of the entire apparatus for controlling the operation of the lock-gates. It included for each machine a master controller, which is located in the tower of the lock-gate house by which either gate is ordinarily operated. With this device the operator is enabled to turn on the current by one quick motion of the controller handle, and the cutting out of resistance from the motors and the changing of the motors from the series to parallel relationship are automatically taken care of by means of the device called a contactor board, also furnished under this contract.

A so-called manual controller for each lock-gate is also furnished, which is located in the lock-gate house close by the lock-gate which it operates. When the gate is controlled from this point, the master controller in the tower room is cut out by means of a suitable switch. This controller operates the motors in series only, and is similar to the controllers used in street car service. Under this contract there was also furnished a limit switch for each lock-gate which automatically stops the gate shortly before coming into the closed position, and from that point to the fully closed position, at which point it again stops the gate, it is possible only to operate at the slowest speed. It also operates through the controlling apparatus to stop the lock-gate, if it is in the wide-open position. In connection with the apparatus above described, there were also furnished suitable indicator lamps to show the operator in the tower the position of the gate being operated, at critical points.

The material had all been delivered and examined at the end of the year, but the final estimate had not been made, as the devices had not been operated and accepted. A payment of \$2,514.30 was made during the year.

Contract No. 69, Camden Iron Works. — Furnishing Cast-iron Pipes and Special Castings, Boston.

On June 27, 1907, a contract was made with the Camden Iron Works for cast-iron pipes and special castings.

This contract was substantially completed during the previous year, and the final estimate, amounting to \$4,761.25, was made Dec. 16, 1907.

Contract No. 70, Patrick McGovern. — Building the Main Portion of the Cambridge Marginal Conduit, Cambridge.

On Aug. 13, 1907, a contract was made with Patrick McGovern for building the main portion of the Cambridge Marginal Conduit.

During the previous year the stop-plank chambers on each side of Lechmere Canal had been completed, and no work was done from Dec. 4, 1907, to Jan. 21, 1908.

The first concrete placed during the year was on March 11, and on March 23 a portable Ransome concrete mixer was started.

The entire work was finished July 6, and the final estimate, amounting to \$47,508.22, was made Sept. 10, 1908, the principal items being: —

Earth excavation and refill for conduit,	. . . . .	1,681.8 lin. ft.
Other earthwork,	. . . . .	1,182.5 cu. yds.
Piles in place,	. . . . .	22,836.6 lin. ft.
Underdrains,	. . . . .	1,610 lin. ft.
Concrete masonry,	. . . . .	2,029 cu. yds.
Sheeting left in place,	. . . . .	55.5 M. ft. B. M.

Contract No. 71, Dodd & McLaughlin. — Furnishing and erecting Tide-Gates, Boston.

On July 16, 1907, a contract was made with Dodd & McLaughlin for tide-gates for the Boston Marginal Conduit overflows, the amount of the contract being \$1,899.30.

This contract called for four yellow pine frames, each with three openings 3 feet 4 inches wide by 6 feet high, and twelve tide-gates or back-water gates to cover these openings, each made

up of yellow pine $2\frac{3}{4}$ inches thick. These gates are furnished with link hinges at the top, two to a gate. The construction of the gates is such that they are sufficiently flexible so that should an obstruction become caught between the gate and the frame at one point it would not prevent the remainder of the gate from closing. One frame and three gates have been placed in each overflow chamber of the Boston Marginal Conduit, located at Pinckney Street, Berkeley Street, Exeter Street and Gloucester Street.

The contract also called for furnishing and delivering the frames, gates, hinges and other appurtenances, and the erection of all except the frames which were set in the masonry by the Commission.

On Feb. 19 the tide-gates were hung in the Pinckney Street overflow chamber.

On June 23 the tide-gate frame for the Exeter Street overflow chamber was delivered.

During October the tide-gates at Berkeley, Exeter and Gloucester streets were tested and adjusted.

At the end of the year all of the gates and frames had been erected and accepted, but as the contract required the final adjustment by the contractor three months after the acceptance, and this had not been done, the final estimate had not been paid. At the end of the year the total payments amounted to \$1,424.48.

*Contract No. 72, American Luxfer Prism Company of Illinois.
— Building Sidewalk Lights at the Sluices, Cambridge.*

On Sept. 12, 1907, a contract was made with the American Luxfer Prism Company of Illinois for building sidewalk lights in the down-stream sidewalk over the sluices at the Dam, the amount of the contract being \$1,350.

This contract called for about 117 linear feet of granolithic sidewalk 6 feet $6\frac{1}{2}$ inches wide, about 96 feet of which was furnished with sidewalk lights. This walk is located over the sluices and the small boat lock on the north side of the roadway. In the rooms directly beneath are located the operating machinery for seven of the sluice-gates furnished under Contract No.

25, with the Coffin Valve Company, and the operating stands come close up to the under side of the sidewalk lights, and at those points the construction of the walk is such that a panel of the walk about $3\frac{1}{2}$ feet by $5\frac{1}{2}$ feet can be readily raised for the removal of the machinery.

The final estimate under this contract, amounting to \$1,350, was made June 23, 1908.

*Contract No. 75, Westinghouse Traction Brake Company. —
Furnishing Air Compressor Plant, Boston.*

On Aug. 30, 1907, a contract was made with the Westinghouse Traction Brake Company for constructing the air compressor plant needed for the Lock. The amount of the contract was \$1,393.20.

This plant consists of two water-cooled, electrically operated air compressors, each having a piston displacement of 50 cubic feet per minute, arranged with an automatic starter. It is to supply air for the forced lubrication systems in the lock-gates, for driving water from compartments of the lock-gates as required, and for various other purposes.

The final estimate, amounting to \$1,393.20, was made March 17, 1908.

*Contract No. 76, Hiram W. Phillips. — Building an Inverted
Siphon for the Cambridge Marginal Conduit, at Lechmere
Canal, Cambridge.*

On Sept. 12, 1907, a contract was made with Hiram W. Phillips for the construction of this siphon.

During December, January and February the dredging was completed.

In March the work of laying the two pipes was started. The last section of pipe was laid by April 30.

All the work under this contract was completed early in September, 1908. The final estimate, calling for \$15,515.43, was made Sept. 10, 1908.

Contract No. 78, The Lockwood Manufacturing Company. — Constructing and erecting a Sluice-gate in the Cambridge Marginal Conduit, Cambridge.

On Sept. 19, 1907, a contract was made with The Lockwood Manufacturing Company for this gate, the amount of the contract being \$1,673.

This gate is to be used only when it is necessary to flush the Cambridge Marginal Conduit. It consists of the cast-iron frame set in the masonry with an opening 6 feet wide by 4 feet 3 inches high, and a cast-iron gate covering this opening. The gate is arranged to slide upon the frame when opening, and the friction surfaces are of bronze. The gate is operated by two threaded bronze stems engaging bronze nuts bolted to the gate. The upper end of one of these stems is fitted with a square nut, which is to be turned by a socket wrench by hand. The other stem is driven from the stem with the nut through beveled gears and an intermediate shaft.

The gate had been furnished, erected, operated and accepted and the final estimate was made Aug. 15, 1908.

Contract No. 81, William H. Ellis. — Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment, Boston.

On Jan. 20, 1908, bids were opened for constructing Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment, and on Jan. 31, 1908, a contract was made for this work with William H. Ellis.

The total amount of the contract, on the basis of the preliminary estimate of quantities, was \$74,700.50.

This contract embraced the extension of the 7-foot and 12-foot Stony Brook conduits, through the Boston Embankment, to the new Basin wall, and a short portion of the Boston Marginal Conduit, amounting in all to about 150 linear feet of conduits; a gate-chamber connecting the Stony Brook conduits with the marginal conduit, of which the main part is about 37 feet by 57 feet; some 320 linear feet of retaining wall, beginning at

the westerly end of Section 3, thence running westerly and southerly to the existing Basin wall at its intersection with Charlesgate West; a stone and concrete arch bridge with wing walls over the new outlet of the Fens Pond; and an earth embankment between the existing Basin wall and the wall to be built under this contract.

The principal items of the preliminary estimate were:—

Coffer-dam at Fens Pond bridge,	1 coffer-dam.
Coffer-dam at gate-chamber,	1 coffer-dam.
Coffer-dam at Boston Marginal Conduit,	1 coffer-dam.
Earth filling,	17,920 cu. yds.
Earth excavation inside coffer-dams,	280 cu. yds.
Piles in place,	36,000 lin. ft.
Concrete masonry,	2,480 cu. yds.
Granolithic surfacing,	117 sq. yds.
Ashlar masonry,	160 cu. yds.
Dimension stone masonry,	80 cu. yds.
Face dressing of pointed work,	4,500 sq. ft.
Riprap,	440 tons.
Iron and other metal work,	28.5 tons.
Temporary outlet from Stony Brook conduits,	1 outlet.

Early in March, 1908, the work of driving sheeting and the excavation for the temporary outlet for the Stony Brook conduits were commenced. A pump was set up on March 23. On April 23 the temporary outlet was completed.

The coffer-dam for the Boston Marginal Conduit was finished on April 23.

The first concrete in the Boston Marginal Conduit was placed on May 21, and this portion of the work was completed on June 6.

On May 11 the work of driving piles for the Basin wall was commenced.

The coffer-dam around the gate-chamber was so far completed that pumping was commenced on May 21 with a 6-inch pump, but this proving insufficient, a 10-inch pump operated with an electric motor was installed on June 4.

The first concrete in the gate-chamber was placed on July 1, and this work was substantially completed in September.

The work of driving piles for the coffer-dam around the bridge

at the outlet of the Fens was started May 26. On July 20 the work of pumping out the coffer-dam was commenced, and on August 11 the first concrete was placed in the foundations for the bridge. The bridge was completed during the last week in October.

The value of the work done at the end of the year, as shown by the November, 1908, estimate, was \$68,481.10, the principal items of which were: —

Coffer-dams,	3
Earth filling,	21,541 cu. yds.
Earth excavation inside coffer-dams,	584 cu. yds.
Piles in place,	24,360 lin. ft.
Drains,	982 lin. ft.
Concrete masonry,	2,022 cu. yds.
Granolithic surfacing,	116 sq. yds.
Stone masonry,	200 cu. yds.
Face dressing of pointed work,	3,453 sq. ft.
Iron and other metal work placed,	31.9 tons.
Temporary outlet from Stony Brook conduits,	1 outlet.

Contract No. 84, Camden Iron Works. — Furnishing Cast-iron Pipes and Special Castings, Cambridge.

On Nov. 4, 1907, bids were received for cast-iron pipes and special castings, and on Dec. 7, 1907, a contract was made with the Camden Iron Works. The amount of the contract, based on the preliminary estimate, was \$1,528.50.

The work consisted of four lengths of 60-inch cast-iron pipe, two 60-inch $\frac{1}{16}$ curves, and one 60-inch $\frac{1}{8}$ curve.

The material was delivered and the final estimate was made April 9, 1908, calling for \$1,580.76.

Contract No. 89, William H. Wood & Company. — Furnishing Spruce Lumber for repairing Temporary Bridge.

On Feb. 6, 1908, bids were received for furnishing the planking required for the temporary Craigie Bridge until Jan. 1, 1909, and on Feb. 13, 1908, the contract was placed with William H. Wood & Company, the lowest bidder. On the basis of the preliminary estimate of lumber required, the total amount of the contract was \$3,300.

The contractor delivered the lumber as needed throughout the year.

The total amount paid on the contract at the end of the year was \$3,029.98.

Contract No. 90, Gibby Foundry Company. — Furnishing and erecting Tide-gates for Sections 5 and 6 of the Boston Marginal Conduit, Boston.

On Mar. 9, 1908, a contract was made with the Gibby Foundry Company for furnishing and erecting tide-gates for Sections 5 and 6 of the Boston Marginal Conduit.

The work to be done consisted in furnishing twenty-four tide-gates of the Dodd type with frames.

The original contract called for \$5,490, but on account of changes made in the marginal conduit as requested by the Boston Transit Commission, reducing the number of tide-gates to fourteen, the amount of the contract was reduced from \$5,490 to \$4,000.

This contract was completed during the year, but only \$3,000 was paid. The final estimate for the unpaid balance of \$1,000 was made Dec. 1, 1908.

Contract No. 91, William L. Miller. — Driving Oak Piles in Front of Bulkhead of Boston Woven Hose and Rubber Company, Broad Canal, Cambridge.

On Feb. 26, 1908, a contract was made with William L. Miller for driving and capping oak piles in front of the bulkhead of the Boston Woven Hose and Rubber Company above the railroad bridge in Broad Canal.

This work was completed and a voucher for the amount of the contract, \$1,008.77, was approved May 19, 1908.

Contract No. 92, The Phoenix Iron Company. — Furnishing Structural Steel for Lower Lock-gate House, Boston.

On April 21, 1908, bids were received for structural steel for the lower lock-gate house, and on April 28, 1908, a contract was made with The Phoenix Iron Company for \$4,570.

The final estimate, calling for \$4,570, was made July 20, 1908.

Contract No. 94, Horton & Hemenway. — Construction of Lower Lock-gate House, Boston.

On June 1, 1908, bids were received for the construction of the lower lock-gate house, and on June 4, 1908, a contract was made with Horton & Hemenway for the construction of the house.

The contract called for furnishing and completing the entire house, except the plumbing, heating, lighting and wiring and the furnishing of the structural steel.

At the end of the year the contractor had the building roofed in, the interior partitions in place and plastered, and was erecting the interior finish.

The value of the work done, as shown by the November, 1908, estimate, was \$26,397.81.

Contract No. 95, Hiram W. Phillips. — Constructing submerged Outlets for the Boston Marginal Conduit, Boston.

On July 7, 1908, bids were received for the construction of five submerged outlets for the Boston Marginal Conduit, and on July 10, 1908, a contract was made with Hiram W. Phillips to do the work for \$42,500.

The work to be done under this contract consisted in constructing five wooden, submerged outlets extending out into the Basin for about 100 feet from the Basin wall, near Fruit Street, Pinckney Street, Berkeley Street, Exeter Street and Gloucester Street.

On July 22 the work of building the wooden box for one of the outlets was started at McKie's shipyard in East Boston. This box was completed and launched on August 4. All of the boxes were built at this yard and then towed to the proper location.

At the end of the year four of these outlets had been placed, and work on the fifth, the one at Gloucester Street, had been started. The value of the work done at the end of the year, as shown by the November, 1908, estimate, was \$25,500.

Contract No. 97, The Merrill Company. — Furnishing and erecting Piping at Lock, Boston.

On July 6, 1908, bids were received for the work to be done under this contract, and on July 7, 1908, a contract was made with The Merrill Company for the work.

This contract included the steam and water piping in the boiler room, the heating system of the lower lock-gate house, radiators in the west Lock wall opposite the lock-gates, steam heat lines to these radiators and to the upper lock-gate house, and also included the air piping in the lower lock-gate house and the air main to the upper lock-gate house, a 4-inch water main under the Lock for supplying water on the Dam, and miscellaneous steam, water and air piping.

At the close of the year the greater part of the piping in the boiler room had been completed, the steam heat main in the lower lock-gate house was installed, and the lower lock-gate house was being heated by radiators made up with temporary connections. A portion of the steam and air mains through the galleries of the Lock walls had been completed as well as the piping under the Lock.

The value of the work done, as shown by the October, 1908, estimate, was \$2,195.64.

Contract No. 99, American Bridge Company of New York. — Furnishing Structural Steel for Upper Lock-gate House, Boston.

On July 6, 1908, bids were received for the structural steel for the upper lock-gate house, and on July 11, 1908, a contract was made with the American Bridge Company of New York for furnishing this steel, the contract price being \$1,475.

The final estimate was made Oct. 6, 1908, for the amount of the contract, \$1,475.

Contract No. 100, The Norcross Brothers Company. — Constructing Upper Lock-gate House, Boston.

On June 29, 1908, bids were received for the construction of the upper lock-gate house, and on July 1, 1908, a contract was

made with The Norcross Brothers Company for the construction of the house, the amount of the contract being \$10,400.

The contract called for the construction of the house with the exception of the structural steel and the electric light wiring and fixtures.

The contractor started to bring his materials on to the work September 8 and commenced actual work on the building September 21. At the end of the year he had the walls erected and the roof boarded in and was ready to start slating.

The value of the work done, as shown by the November, 1908, estimate, was \$4,680.

Contract No. 101, Buerkel & Company. — Furnishing and installing Plumbing for Lower Lock-gate House, Boston.

On July 13, 1908, bids were received for furnishing and installing plumbing for the lower lock-gate house, and on July 16, 1908, a contract for the work was made with Buerkel & Company, of Boston, the amount of the contract being \$1,388.

The work consisted in furnishing and installing all the plumbing at the lower lock-gate house.

At the end of the year the contractor had completed the entire work, with the exception of installing the fixtures, and payments amounting to \$821.98 had been made.

Contract No. 103, The Cutler-Hammer Manufacturing Company. — Furnishing Controlling Apparatus for Sluice-gates at Fens Gate-chamber, Boston.

On Aug. 8, 1908, a contract was made with The Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., for the controlling apparatus for the sluice-gates at the Fens gate-chamber, the amount of the contract being \$1,025.

The work to be done consisted in furnishing, f. o. b., Milwaukee, controlling devices for the five 7½ H. P., 220-volt, series wound electric motors for operating the sluice-gates, the equipment to be furnished to consist of five drum type controllers, five water-tight limit switches, and one switchboard with all the necessary instruments, appliances, etc.

At the end of the year none of the material had been delivered and no payment had been made.

*Contract No. 104, Chapman Valve Manufacturing Company.
— Furnishing Sluice-gates for Fens Gate-chamber, Boston.*

On July 22, 1908, bids were received for the five sluice-gates for the Fens gate-chamber, and on August 7, 1908, a contract was made with the Chapman Valve Manufacturing Company for the gates, the price to be \$7,220.

The work to be done under this contract consisted in furnishing and delivering, sound and complete in all respects, five sluice-gates and frames having clear openings 6 feet 4 inches wide and 7 feet 8¼ inches high, complete with operating stands, ready for erection.

These gates had not been delivered at the end of the year and no payment had been made.

Contract No. 105, Coleman Brothers. — Building a Part of the Cambridge Marginal Conduit, Cambridge.

Bids for this work were received, and on Aug. 19, 1908, a contract for the work was made with Coleman Brothers, the amount of the contract, on the basis of the engineers' preliminary estimate of quantities, being \$10,837.

The work to be done consisted in constructing the Cambridge Marginal Conduit from the stop-plank chamber on the north-erly side of Lechmere Canal to that portion of the conduit which had been constructed under Contract No. 1 in connection with the construction of the Dam.

The principal items called for under the contract were: —

Earth excavation and filling,	5,400 cu. yds.
Piles,	5,900 lin. ft.
Drains,	200 lin. ft.
Concrete,	190 cu. yds.
Sheeting left in place,	48 M. ft. B. M.
Removal of wall,	45 lin. ft.
Removal of stable,	1 stable.

The excavation for the trench was started the last week in August.

During September the old sea-wall was removed and the work of driving sheeting was commenced.

The work of placing concrete was started October 26.

At the end of the year the work was substantially completed. The value of the work done, as shown by the November, 1908, estimate, was \$6,755.

Contract No. 106, William L. Miller. — Rebuilding Wall at Wharf of Bay State Fuel Company, on Broad Canal, Cambridge.

On Sept. 24, 1908, a contract was made with William L. Miller for rebuilding the wall in front of the coal wharf of the Bay State Fuel Company on Broad Canal, Cambridge.

The work to be done consisted in removing the existing wall and oak piling and rebuilding the wall and redriving the piling for a distance of about 330 feet.

This work was pushed rapidly and at the end of the year was entirely completed, but the final estimate had not been paid.

Contract No. 107, The Brown Hoisting Machinery Company. — Furnishing Two Traveling Cranes for the Lock-gate Houses, Boston.

On Oct. 5, 1908, a contract was made with The Brown Hoisting Machinery Company for two traveling cranes, one for each lock-gate house.

The contract called for two 5-ton pulley block traveling cranes, the crane for the lower lock-gate house to have a span of 31 feet 9 inches center to center of rails and a hoist of 48 feet 6 inches, the crane for the upper lock-gate house to have a span of 34 feet 6 inches center to center of rails and a hoist of 40 feet 6 inches, and the hoisting mechanisms for the cranes to consist of Yale & Towne triplex combinations of 5 tons capacity.

These cranes had not been delivered at the end of the year and no payment had been made.

Contract No. 111, American Luxfer Prism Company of Illinois.
— *Building Sidewalk Lights at the Lower Lock-gate House, Boston.*

On Oct. 19, 1908, a contract was made with the American Luxfer Prism Company of Illinois for building sidewalk lights at the lower lock-gate house for \$1,019.

The work to be done consisted in building a sidewalk over the coal pocket in front of the lower lock-gate house.

At the end of the year the contractor had just completed the work under this contract, but no payment had been made.

Contract No. 112, William H. Ellis. — Constructing a Submerged Intake for the Salt Water Sluice at the Sluices, Cambridge.

On Nov. 24, 1908, bids were opened for the construction of a submerged intake for the salt water sluice connecting with one of the large flood sluices on the Cambridge side, and on Nov. 28, 1908, a contract was made with William H. Ellis for the construction of the work, the price being \$4,884.

The work called for under this contract consisted of the construction of a wooden box extending from the Basin wall at the Dam, east of the sluices, down about 25 feet to the bottom of the Basin.

No work was done under this contract during the year.

Contract No. 113, Consumers' Coal Corporation. — Anthracite Coal for the Boiler Plant at the Lock, Boston.

On Nov. 24, 1908, bids were received for 200 tons of anthracite coal for use at the boiler plant at the Lock, and on Nov. 27, 1908, a contract was made with the Consumers' Coal Corporation, of Boston, the price to be \$5.74 per ton, on the basis of 4.68 per cent. of ash. The contract provided that for an increase up to 2 per cent. in the ash contained above or below the standard, no correction was to be made in the price. When the variation exceeded 2 per cent. above or below the standard, corrections in the price were to be made as follows: for variations from the standard percentage of ash exceeding 2 per cent. and

less than 2.5 per cent. above and below, the deduction or addition of 15 cents per ton, respectively, was to be made; for each additional one-half of 1 per cent. or fraction thereof, 3 cents per ton more was to be deducted or added, respectively. The contract also stated that coal containing more than 1 per cent. of sulphur or ash in excess of 14 per cent. would be rejected and must be removed by the contractor.

A very small quantity of coal had been delivered at the end of the year, but no payment had been made.

Respectfully submitted,

HIRAM A. MILLER,

Chief Engineer.

Boston, Oct. 1, 1909.

APPENDIX A.

APPENDIX A.

CHAPTER 465 OF THE ACTS OF THE YEAR 1903.

AN ACT TO AUTHORIZE THE CONSTRUCTION OF A DAM ACROSS THE CHARLES RIVER BETWEEN THE CITIES OF BOSTON AND CAMBRIDGE.

Be it enacted, etc., as follows:

SECTION 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Charles river
basin commis-
sion, appoint-
ment, term,
etc.

Compensation.

SECTION 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Powers and
duties.

Dam to be
constructed
across Charles
river, etc.

SECTION 3. The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

Navigable
channels to be
dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third Street draw, not less than thirteen feet of water from the Third Street draw to the Sixth Street draw, and not less than eleven feet of water from the Sixth Street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf, and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak pilcs two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

Manner of
dredging, etc.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Certain other
dredging to be
done, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Marginal
conduits to be
constructed,
etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide-water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are

Certain lands,
etc., may be
taken, etc.

situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metropolitan park commission to have exclusive control of dam, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency,

May make rules and regulations, etc.

requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

SECTION 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

SECTION 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cam-

Apportionment of expenses, etc.

bridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one-half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston
to do certain
dredging,
construct con-
duits, sewer,
etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act, do such dredging in the Back Bay Fens as the board of health of said city may require, shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook, shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river, and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however*, that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for out of the annual appropriation for sewer construction under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Proviso.

Wall or em-
bankment may
be built on
Boston side of
Charles river.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running

southerly by a straight or curved line to a point in Charles river not more than three hundred feet distant westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall to the easterly line of the Back Bay Fens, extended to intersect said parallel line.

SECTION 12. The board of park commissioners of said city may take, in fee or otherwise, by purchase or otherwise, for said city, for the purpose of a public park such lands, flats and lands covered by tide-water between Charles, Brimmer and Back streets and the line of the wall or embankment aforesaid, as the mayor shall approve, by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of the commissioners, and shall construct a public park on the lands so taken; and any person whose property is so taken may have compensation therefor as determined by agreement with the board, and if they cannot agree the amount thereof may be determined by a jury in the superior court for the county of Suffolk, under the same provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the board, or by such person, filed in the clerk's office of said court against said city within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

Certain lands, flats, etc., may be taken for a public park.

SECTION 13. The city of Boston shall pay the expenses incurred under sections ten, eleven and twelve of this act, except as otherwise provided in section ten of this act; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount

City of Boston to pay certain expenses, etc.

City treasurer to issue bonds, etc.

not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

The Boston and Maine Railroad to remove certain structures, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles River which are southerly or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement of provisions of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act and any order, rule or regulation made under authority thereof.

Repeal.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed.

When to take effect.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three. [Approved June 24, 1903.]

CHAPTER 107 OF THE RESOLVES OF THE YEAR 1904.

RESOLVE TO PROVIDE FOR THE ACCEPTANCE BY THE COMMONWEALTH OF THE CONDITIONS AND LIMITATIONS SET FORTH IN A CERTIFICATE OF THE ACTING SECRETARY OF WAR OF THE UNITED STATES RELATING TO THE CONSTRUCTION AND MAINTENANCE OF THE CHARLES RIVER DAM.

Resolved, That the express conditions and limitations set forth in a certificate of Robert Shaw Oliver, acting secretary of war, under date of the eighteenth day of May, nineteen hundred and four, relating to the construction and maintenance of a dam across the Charles river, and to the maintenance of channels in connection therewith, be, and hereby are, accepted, and the obligations thereof assumed by the Commonwealth, as follows:—

Construction of Charles river dam, etc., acceptance of certain conditions, etc.

1. That detailed plans for the lock and dam, and of all channels to be dredged outside established harbor lines, shall be submitted to the secretary of war, and that the work be not begun until such plans have received his approval.

2. That the Charles River basin commission, or its successors, shall operate the lock, at their own expense, as a free navigable waterway of the United States, subject to such regulations as the secretary of war may promulgate.

3. That the emptying of the basin shall be subject to regulation by the secretary of war.

4. That the Charles River basin commission shall dredge and maintain in the basin, from the head of the lock to the channel in the river, a channel one hundred feet wide and eighteen feet deep at mean low water, in a location to be approved by the secretary of war.

5. That, whenever called upon to do so by the secretary of war, the Charles River basin commission shall deepen two and two tenths feet the channel eighty feet wide called for by the present approved project for the improvement of Charles river by the United States,

known as the project of June fourteen, eighteen hundred and eighty, the said deepening to extend as far as Brackett's wharf.

6. That the Commonwealth of Massachusetts shall maintain in the Charles river from the head of the thirty-five foot channel at Charles river bridge to the dam and lock, the necessary depth and width of channel for the commerce of the river, as fixed by the secretary of war.

7. That the alterations in the bridge of the Boston and Maine Railroad ordered by said act of the general court of Massachusetts shall be made, approval of the plans by the secretary of war being obtained, as required by law.

8. That the approval hereby granted shall not be construed as authorizing any invasion of property rights, or any act whereby a claim for damages against the United States might arise. [*Approved June 8, 1904.*]

CHAPTER 65 OF THE ACTS OF THE YEAR 1905.

AN ACT TO AUTHORIZE THE CHARLES RIVER BASIN COMMISSION TO CONSTRUCT A TEMPORARY HIGHWAY BRIDGE OVER THE CHARLES RIVER.

Be it enacted, etc., as follows:

1903, 465, § 3,
amended.

SECTION 1. Section three of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three is hereby amended by inserting after the word "commission", in the eighth line, the words:—The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of vehicles and pedestrians during the construction of the dam,—so as to read as follows:—*Section 3.* The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of

Dam to be constructed across Charles river, etc.

the present Craigie bridge, which shall be removed by the commission. The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of vehicles and pedestrians during the construction of the dam. The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

SECTION 2. This act shall take effect upon its passage. [*Approved February 9, 1905.*]

CHAPTER 158 OF THE ACTS OF THE YEAR 1906.

AN ACT TO PROHIBIT THE POLLUTION OF THE CHARLES RIVER WITHIN THE METROPOLITAN PARKS DISTRICT.

Be it enacted, etc., as follows:

SECTION 1. The state board of health is hereby authorized, upon the petition of the metropolitan park commission, or the mayor of any city or the selectmen of any town within the metropolitan parks district, and after notice to all parties interested and a hearing, to prohibit the entrance or discharge of sewage into that part of the Charles river within the present boundaries of said metropolitan parks district, and to prevent the entrance or discharge of every other substance, except surface or storm water, into said river within said parks district which may be injurious to public health, or may tend to create a public nuisance, or to obstruct the flow of water within said parks district, including all waste

The state board of health may prohibit the discharge of sewage into Charles river, etc.

or refuse from any factory or other establishment where persons are employed, unless the owner thereof shall use the best practicable and reasonably available means to render such waste or refuse harmless.

Jurisdiction.

SECTION 2. The supreme judicial court or any justice thereof and the superior court or any justice thereof shall have jurisdiction in equity to enforce the provisions of this act and any order made by the state board of health in conformity therewith. Proceedings to enforce any such order shall be instituted and prosecuted by the attorney-general upon the request of the state board of health.

SECTION 3. This act shall take effect upon its passage. [*Approved March 14, 1906.*]

CHAPTER 368 OF THE ACTS OF THE YEAR 1906.

AN ACT RELATIVE TO THE TRANSFER OF THE CARE AND CONTROL OF THE CHARLES RIVER DAM AND BASIN TO THE METROPOLITAN PARK COMMISSION.

Be it enacted, etc., as follows:

1903, 465, § 3,
amended.

SECTION 1. Section three of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three is hereby amended by striking out the last sentence thereof, so as to read as follows: — *Section 3.*

Dam to be constructed across Charles river.

The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet

in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances.

SECTION 2. Section seven of said chapter four hundred and sixty-five is hereby amended by inserting after the word "exclusive", in the fourth line, the words:— care and, — by inserting after the word "lock", in the fifth line, the words:— and of any highway, park or parkway, drawbridge or drawbridges, constructed in connection therewith, — by inserting after the word "lock", in the ninth line, the words:— highway, park or parkway, drawbridge or drawbridges, — by striking out the words "the part of the dam used as a highway and", in the tenth line, by striking out the word "the", before the word "basin", in the fourteenth line, and inserting in place thereof the word:— said, — by inserting after the word "basin", in the fourteenth line, the words:— dam, lock, highway, park, parkway, drawbridge or drawbridges, breaches of which rules shall be breaches of the peace, punishable as such, — by inserting after the word "lock", in the fifteenth line, the words:— and drawbridge or drawbridges, — and by adding at the end thereof the words:— Said metropolitan park commission shall also have and exercise over said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, all other power, duties and liabilities now imposed upon said commission by chapter four hundred and seven of the acts of the year eighteen hundred and ninety-three and acts in addition thereto and in amendment thereof relative to the care, maintenance and control by said commission of open spaces for exercise and recreation so far as the provisions of said acts are consistent with the provisions of this act, — so as to read as follows:— *Section 7.* The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive care and control of the dam and lock and of any highway, park or parkway, drawbridge or drawbridges, con-

1903, 465, § 7,
amended.

The metro-
politan park
commission to
have care of
dam, etc.

structed in connection therewith and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, highway, park or parkway, drawbridge or drawbridges, and of the placing thereof, except the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, breaches of which rules shall be breaches of the peace, punishable as such; and throughout the year shall operate the lock and drawbridge or drawbridges without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission. Said metropolitan park commission shall also have and exercise over said basin, dam, lock, highway, park, parkway, drawbridge or drawbridges, all other power, duties and liabilities now imposed upon said commission by chapter four hundred and seven of

the acts of the year eighteen hundred and ninety-three and acts in addition thereto and in amendment thereof relative to the care, maintenance and control by said commission of open spaces for exercise and recreation so far as the provisions of said acts are consistent with the provisions of this act.

SECTION 3. When the work of the Charles river basin commission as provided for in said chapter four hundred and sixty-five is finished, said commission shall certify the fact in writing to the metropolitan park commission, and such certificate or a copy of the same, attested by any member of the metropolitan park commission or by its secretary, shall be prima facie evidence that the exclusive care and control of said dam, lock, highway, park or parkway, drawbridge or drawbridges, are vested in the metropolitan park commission.

When dam is completed the Charles river basin commission to certify the same, etc.

SECTION 4. So much of chapter four hundred and sixty-seven of the acts of the year eighteen hundred and ninety-eight as is inconsistent herewith is hereby repealed.

Repeal.

SECTION 5. This act shall take effect upon its passage. [*Approved May 8, 1906.*]

CHAPTER 402 OF THE ACTS OF THE YEAR 1906.

AN ACT RELATIVE TO THE CHARLES RIVER BASIN.

Be it enacted, etc., as follows:

SECTION 1. Section eight of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three is hereby amended by striking out the words "the preceding", in the third line, by inserting after the word "sections", in the same line, the words: — one, two, three, four, five, six, seven, eleven and twelve, as amended, — and by striking out the words "the first six sections", in the thirteenth line, and inserting in place thereof the words: — sections one, two, three, four, five, six, eleven and twelve, — so as to read as follows: — *Section 8.* The Commonwealth shall in the first instance pay all expenses incurred in carrying out the

1903, 465, § 8, amended.

Payment of expenses.

provisions of sections one, two, three, four, five, six, seven, eleven and twelve, as amended, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under sections one, two, three, four, five, six, eleven and twelve of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip, and to their payment.

1903, 465, § 9,
amended.

Apportion-
ment of ex-
penses.

SECTION 2. Said chapter four hundred and sixty-five is hereby further amended by striking out section nine and inserting in place thereof the following:—*Section 9.* The commissioners appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under sections one, two, three, four, five, six, seven, eight, eleven and twelve of this act; shall also determine as they shall deem just and equitable what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system; and shall also determine as they shall deem just and equitable, what portion of the total amount expended for the cost of construction of the marginal

conduit on the south side of the basin and of the embankment and park, provided for by this act, shall be apportioned to the city of Boston as the cost of the construction of said embankment and park, and what portion shall be fixed as the cost of said marginal conduit. The cost of the construction of said embankment and park, as so apportioned, shall be repaid to the Commonwealth by the city of Boston with four per cent interest from the date of said apportionment, and bills for the betterments assessed by the Charles River Basin commission under the provisions of this act shall be listed and committed to the collector of taxes of the city of Boston, and shall be collected under the same provisions of law as betterments levied for the construction of highways in the city of Boston. All amounts so received by the city of Boston from said betterments shall be applied first toward paying to the Commonwealth said apportionment for the cost of construction of said embankment and park as above provided; and second to the interest and sinking fund requirements of the loan of the city of Boston authorized by this act. The treasurer and receiver general shall determine the payments to be made each year by the cities of Boston and Cambridge, one half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as a part of its state taxes. The city treasurer of Boston shall from time to time on the request of the mayor issue and sell bonds of the city to meet the payments to the Commonwealth required by this section, and the bonds so issued shall not be reckoned in determining the statutory limit of indebtedness of the city.

SECTION 3. Said chapter four hundred and sixty-five is hereby further amended by striking out section eleven and inserting in place thereof the following:—
Section 11. The Charles River Basin commission shall build a wall and embankment on the Boston side of Charles river, beginning at a point in the southwest

1903, 465, § 11,
amended.

Wall and embankment may be built on Boston side of Charles river.

corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from the said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall, but at no point more than one hundred feet distant therefrom, to the westerly line of the Back Bay Fens extended to intersect said parallel line.

1903, 465, § 12,
amended.

Certain lands,
etc., may be
taken for a
public park.

Proviso.

SECTION 4. Said chapter four hundred and sixty-five is hereby further amended by striking out section twelve and inserting in place thereof the following:—

Section 12. The Charles River Basin commission shall acquire in fee, or otherwise, by purchase or otherwise, for the city of Boston, for the purpose of a public park, parkway or street, flats and lands covered by tide water and lying easterly of Charlesgate West by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of said commission, and shall construct a public park or lay out a parkway or street, on the lands so taken: *provided, however,* that nothing herein contained shall authorize the taking for any purpose of Back street, or of any lot or part of any lot on the north side of Beacon street or of any flats or lands covered by tide water south of West Boston bridge and lying between the line of the wall the construction whereof is provided for in section eleven of this act and the Cambridge shore, nor the taking for any purpose but that of a public park of any flats or land covered by tide water between said wall and the sea wall as at present existing; and any person whose property is so taken may have compensation therefor as determined

by agreement with the commission, or, in the absence of such agreement, the amount thereof may be determined by a jury in the superior court for the county of Suffolk upon petition therefor by the commissioners or by such person, filed in the clerk's office of said court, against the Commonwealth, and within one year after the taking, and under the same proceedings and provisions of law, so far as they may be applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws. And because of the construction and maintenance of the embankment and park as herein provided and the establishment of the northerly line thereof as herein finally fixed and defined as the limit of any embankment or construction northerly from Beacon street between the Charlesbank and the Back Bay Fens, said commission shall within two years after the completion of the park as herein provided and defined determine the value of the benefit or advantage, from the establishment of said embankment and park, beyond that resulting to all real estate in the city of Boston, to each parcel of real estate east of the Back Bay Fens bordering upon or near said embankment and park as so completed, and shall assess such betterment upon the said estates so benefited; but such assessments shall in no event exceed in the aggregate one half of the actual cost of construction of said embankment and park, exclusive of the cost of the marginal conduit, nor the sum of thirty dollars for each lineal front foot of private ownership. Any person aggrieved by such assessment of betterments may within one year thereafter file a petition in the superior court for the county of Suffolk, and after notice to the city of Boston shall have a trial by jury therein, and costs shall be awarded as provided in section seven of chapter fifty of the Revised Laws.

SECTION 5. Section thirteen of said chapter four hundred and sixty-five is hereby amended by striking out the words "sections ten, eleven and twelve", in the second line, and inserting in place thereof the words: —

1903, 465, § 13,
amended.

City of Boston
to pay certain
expenses.

section ten, — and by striking out the words “section ten of this act”, in the third and fourth lines, and inserting in place thereof the words: — said section ten, — so as to read as follows: — *Section 13.* The city of Boston shall pay the expenses incurred under section ten of this act, except as otherwise provided in said section ten; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

Repeal.

SECTION 6. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one and chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three are hereby repealed.

SECTION 7. This act shall take effect upon its passage. [*Approved May 21, 1906:*

CHAPTER 404 OF THE ACTS OF THE YEAR 1907.

AN ACT TO AUTHORIZE THE METROPOLITAN PARK COMMISSION JOINTLY WITH THE CHARLES RIVER BASIN COMMISSION TO GRANT LOCATIONS FOR BOAT HOUSES.

Be it enacted, etc., as follows:

Locations of
boat houses on
Charles river.

SECTION 1. The Charles river basin commission shall make provision in the construction and laying out of the park or parkway provided for by chapter four hundred and two of the acts of the year nineteen hundred and six, for the location of boat houses, landings thereon and floats in connection therewith. At any time after the passage of this act, upon the petition of any duly organized boat club for a location for a boat house, landing or floats in connection therewith, said commission and the metropolitan park commission by a majority of the members of both commissions acting jointly as one board for the purpose, and, after the

completion by said Charles river basin commission of the work imposed upon it by law, the metropolitan park commission alone, may grant to such boat club a suitable location, by lease or otherwise, with the right to erect a boat house thereon and to project landings and floats on the waters of the Charles river contiguous thereto, upon such terms, conditions, restrictions and agreements and for such period of years, not exceeding twenty-five, as said commissions acting jointly, or, after the completion of said work, as the metropolitan park commission may deem expedient. In passing upon such petition consideration shall be given to the fact that at the time of the passage of this act such boat club owned or occupied a boat house on the southerly or easterly side of the Charles river between Charlesgate west and the new dam, the point on the river bank at which such boat house was situated and the length of time during which it had been owned or maintained there.

SECTION 2. This act shall take effect upon its passage. [*Approved May 13, 1907.*]

CHAPTER 445 OF THE ACTS OF THE YEAR 1908.

AN ACT TO AUTHORIZE THE CHARLES RIVER BASIN COMMISSION TO TAKE LAND FOR AN APPROACH TO THE EMBANKMENT ON THE BOSTON SIDE OF THE RIVER.

Be it enacted, etc., as follows:

SECTION 1. The Charles river basin commission, for the purpose of constructing an approach from Charles street in the city of Boston to the embankment provided for in chapter four hundred and sixty-five of the acts of the year nineteen hundred and three, as amended by chapter four hundred and two of the acts of the year nineteen hundred and six, may take in fee or otherwise, or acquire by purchase or otherwise, for the city of Boston, so much of the land belonging to the trustees of the Massachusetts Charitable Eye and

Certain land may be taken for the construction of an approach to the embankment on the Boston side of the Charles river.

Description of
land to be filed,
etc.

Ear Infirmary on said Charles street as the commission may deem necessary, by filing in the registry of deeds for Suffolk county a description thereof signed by a majority of the commissioners, and may construct on the land so taken and on the land of the city of Boston between said land and the Cambridge bridge a suitable approach to said embankment.

Damages.

SECTION 2. The city of Boston and any person whose property is taken under authority of this act may have compensation therefor as determined by agreement with the commission, and if they cannot agree, compensation may be determined by a jury in the superior court for the county of Suffolk under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission or by such person, filed in the clerk's office of said court against the commonwealth or the city of Boston, within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

Payment of
expense.

SECTION 3. The commonwealth shall, in the first instance, pay all expenses incurred in carrying out the provisions of this act, including the fair value of any land of the city of Boston which may be used as an approach to said embankment, and the same shall constitute a part of the cost of construction of the embankment authorized by said chapter four hundred and two.

SECTION 4. This act shall take effect upon its passage. [*Approved April 24, 1908.*]

CHAPTER 633 OF THE ACTS OF THE YEAR 1908.

AN ACT TO AUTHORIZE THE CHARLES RIVER BASIN COMMISSION TO REBUILD A CERTAIN SEA WALL ON BROAD CANAL IN THE CITY OF CAMBRIDGE.

Be it enacted, etc., as follows:

Sea wall to be
built on Broad
Canal in the
city of Cam-
bridge.

SECTION 1. The Charles river basin commission, created under the provisions of chapter four hundred

and sixty-five of the acts of the year nineteen hundred and three, is hereby authorized and required to rebuild the sea wall on the premises leased by the Bay State Fuel Company on Broad Canal in the city of Cambridge, according to a plan or plans mutually agreed upon between the commission, the Bay State Fuel Company and the owners of the land whereon the sea wall is to be rebuilt, and to drive sheeting, if the commission deems it necessary, for a distance of three hundred and thirty feet from station eleven plus seventy of the commission's survey on the southerly side of Broad Canal in the city of Cambridge to station fifteen hundred: *provided, however,* that before the commission does any Proviso. work under authority of this act said Bay State Fuel Company and the owners of said land shall execute and deliver to the commission an agreement under seal to defend the commission and its employees and agents, and the commissioners personally and their successors, against all claims of every name and nature which may be prosecuted at law or in equity on account of reducing the navigable width of the canal or on account of any act or acts of the commission in carrying out the provisions of this act, and to save harmless from any and all damages the commonwealth of Massachusetts, the commission and its employees and agents, and the commissioners personally and their successors, in any action brought as aforesaid, and expressly providing that said Bay State Fuel Company and said owners of said land shall hold the commonwealth of Massachusetts, the commission, its members and their successors, and its employees and agents harmless against any and all damage to buildings or other property of said Bay State Fuel Company or of said owners of said land, resulting from the carrying out of the provisions of this act, and also providing that the Bay State Fuel Company shall repay to the commonwealth one-third part of the expense incurred by the commission hereunder, and further providing that, after the completion of the work done by the commission under authority of this act, no repairs on or rebuilding of said

walls or wharves leased by the Bay State Fuel Company shall be required to be done by the commonwealth, and upon the further conditions that, as the work progresses, the Bay State Fuel Company shall remove buildings or parts of buildings as the commission or its employees may require, and shall prevent coal and earth from sliding into any excavation made by the commission for rebuilding the wall, and shall provide storage room on the property for the earth and stone excavated by the commission in rebuilding the wall, and shall permit the commission to occupy such space as it may require for the prosecution of the work; and *provided, further*, that before the said commission shall do any work hereunder, the Bay State Fuel Company and the owners of said land shall execute and deliver a bond satisfactory to the commission both as to amount and otherwise, with a surety or sureties approved by said commission, guaranteeing the faithful performance upon the part of said Bay State Fuel Company and the owners of said land, of the agreements herein provided to be made and performed upon their part.

Proviso.

Payment of expenses.

SECTION 2. All expenses incurred in carrying out the provisions of this act shall be paid out of the treasury of the commonwealth in the same manner as all other expenses incurred under the provisions of chapter four hundred and sixty-five of the acts of the year nineteen hundred and three.

SECTION 3. This act shall take effect upon its passage. [*Approved June 12, 1908.*]

APPENDIX B.

APPENDIX B.

CONTRACTS MADE AND PENDING

	1. No. of Con- tract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
				4. Next to Lowest.	5. Lowest.	
1	1	Dam and Lock in the Charles River.	11	\$801,607 50 ¹	\$761,900 00	Holbrook, Cabot & Rollins Corporation.
2	5	Pumps,	2	9,533 00 ¹	7,423 00	Henry R. Worthington.
3	19 ²	Plans, specifications, engineering and patent rights for superstructure, operating machinery, etc., for drawbridge over Lock.	— ³	— ³	4,500 00 ¹	The Scherzer Rolling Lift Bridge Company.
4	23 ²	Piles along walls of canals and Basin.	— ³	— ³	55,117 26 ¹	Holbrook, Cabot & Rollins Corporation.
5	24 ²	Scherzer rolling lift bridge.	7	41,562 00	40,800 00 ¹	American Bridge Company of New York.
6	25	Sluice-gates at the sluices in the Dam.	2 ⁴	27,993 00	24,800 00 ¹	Coffin Valve Company.
7	27	Sluice-gates on the lock-gates in the Lock.	— ³	— ³	17,093 00 ¹	Coffin Valve Company.
8	28 ²	Tide-gates at the Dam and Lock.	2	4,907 00	4,438 00 ¹	Coffin Valve Company.
9	30	Lock-gates,	4	30,975 00	26,784 00 ¹	New Jersey-West Virginia Bridge Company.
10	34 ²	White oak lumber for Lock.	1	—	646 43 ¹	George McQuesten Company.
11	37 ²	Electric dock capstans at Lock.	2 ⁵	2,100 00 ¹	1,676 00	American Ship Windlass Company.
12	41	Sluice-gates at the sluices and Boston Marginal Conduit.	— ³	— ³	11,862 00 ¹	Coffin Valve Company.
13	44	Section 3 of the Boston Marginal Conduit and Section 1 of the Boston Embankment.	7	241,845 00	232,700 00 ¹	Coleman Brothers.

¹ Contract based upon this bid.² Contract completed.³ Competitive bids were not received on this contract.

APPENDIX B.

DURING THE YEAR ENDING NOV. 30, 1908.

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1908.	
Jan. 14, '05,	Nov. 15, '09,	-	- -	\$950,500 00	\$736,236 02	1
Sept. 30, '05,	-	-	- -	9,533 00	9,326 40	2
Aug. 25, '05,	-	Apr. 3, '08,	- -	4,500 00	4,500 00	3
Dec. 4, '05,	-	Mar. 2, '08,	- -	82,063 73	82,063 73	4
Mar. 16, '06,	-	Apr. 7, '08,	- -	40,814 42	40,814 42	5
Mar. 16, '06,	-	-	- -	24,800 00	21,080 00	6
Mar. 6, '06,	-	-	- -	17,093 00	14,303 70	7
Mar. 16, '06,	-	Dec. 16, '07,	- -	4,438 00	4,438 00	8
June 13, '06,	-	-	- -	26,784 00	25,129 98	9
Apr. 11, '06,	-	Dec. 28, '07,	- -	832 99	832 99	10
May 24, '06,	-	Dec. 23, '07,	- -	2,210 00	2,210 00	11
June 14, '06,	-	-	- -	11,862 00	9,904 20	12
Sept. 24, '06,	-	-	- -	328,000 00	280,956 38	13

⁴ Bids were based on different plans and specifications.⁵ Bids were upon different types of capstans.

CONTRACTS MADE AND PENDING DURING

	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
				4. Next to Lowest.	5. Lowest.	
1	48	Steam, water and air piping.	9	\$2,158 00	\$2,098 00 ¹	The Lumsden & Van Stone Company.
2	50	Sections 4 and 5 of the Boston Marginal Conduit and Sections 2 and 3 of the Boston Embankment.	5	200,860 00 ²	198,890 00 ^{1,2}	Holbrook, Cabot & Rollins Corporation.
3	51	Boiler plant, . . .	6	2,068 00	2,030 00	Lynch & Woodward.
4	57 ³	Spruce lumber for repairing temporary bridge.	4	3,320 00	3,150 00 ¹	William H. Wood & Company.
5	59 ³	Timber ice-run sluice-gate.	1	—	847 00 ¹	The Lockwood Manufacturing Company.
6	60 ³	Lock-gate operating machinery.	4	10,000 00 ¹	9,408 00 ⁴	Link-Belt Company.
7	63 ³	Lock-gate operating chain supports.	1	—	4,543 00 ¹	Baltimore Bridge Company.
8	66	Controlling devices for operating motors of main lock-gates.	— ⁵	— ⁵	2,958 00 ¹	The Cutler-Hammer Manufacturing Company.
9	69 ³	Cast-iron pipes and special castings.	3	5,076 90	4,700 45 ¹	Camden Iron Works.
10	70 ³	Main portion of the Cambridge Marginal Conduit.	5	59,835 00	55,320 00 ¹	Patrick McGovern.
11	71	Tide-gates for Boston Marginal Conduit.	— ⁵	— ⁵	1,899 30 ¹	Dodd & McLaughlin.
12	72 ³	Sidewalk lights at the sluices.	1	—	1,350 00 ¹	American Luxfer Prism Company of Illinois.
13	74 ³	2-inch pump at Lock.	2 ⁶	600 00	495 00 ¹	The Lawrence Machine Company.
14	75 ³	Air compressor plant.	4 ⁷	1,393 20 ¹	1,025 00	Westinghouse Traction Brake Company.
15	76 ³	Inverted siphon for the Cambridge Marginal Conduit at Lechmere Canal.	1	—	14,500 00 ¹	Hiram W. Phillips.
16	78 ³	Sluice-gate in the Cambridge Marginal Conduit.	1	—	1,673 00 ¹	The Lockwood Manufacturing Company.
17	79 ³	Structural steel for the Cambridge Marginal Conduit and the sluices.	4	515 00	467 00 ¹	H. P. Converse & Company.
18	80 ³	Gate stems and guide brackets for the Lock and the Cambridge Marginal Conduit.	1	—	227 00 ¹	The Lockwood Manufacturing Company.

¹ Contract based upon this bid.² This bid was on Section 4 of the Boston Marginal Conduit and Section 2 of the Boston Embankment.³ Contract completed.

THE YEAR ENDING NOV. 30, 1908 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1908.	
Oct. 20, '06,	—	—	— —	\$2,098 00	\$629 40	1
Nov. 5, '06,	—	—	— —	390,000 00	284,149 46	2
Dec. 4, '06,	Nov. 7, '08,	—	— —	2,164 00	541 00	3
Feb. 4, '07,	Jan. 1, '08,	Feb. 1, '08,	— —	3,501 68	3,501 68	4
June 3, '07,	Feb. 24, '08,	Feb. 25, '08,	— —	847 00	847 00	5
Apr. 23, '07,	—	May 15, '08,	— —	10,030 05	10,030 05	6
May 9, '07,	—	June 15, '08,	— —	5,143 00	5,143 00	7
May 22, '07,	—	—	— —	2,958 00	2,514 30	8
June 27, '07,	Aug. 27, '07,	Dec. 16, '07,	— —	4,761 25	4,761 25	9
Aug. 13, '07,	—	Sept. 10, '08,	— —	47,508 22	47,508 22	10
July 16, '07,	—	—	— —	1,899 30	1,424 48	11
Sept. 12, '07,	—	June 23, '08,	— —	1,350 00	1,350 00	12
Aug. 9, '07,	Dec. 27, '07,	June 30, '08,	— —	493 20	493 20	13
Aug. 30, '07,	Nov. 13, '07,	Mar. 17, '08,	— —	1,393 20	1,393 20	14
Sept. 12, '07,	May 1, '08,	Sept. 10, '08,	— —	15,515 43	15,515 43	15
Sept. 19, '07,	—	Aug. 15, '08,	— —	1,673 00	1,673 00	16
Sept. 9, '07,	Dec. 8, '07,	Dec. 13, '07,	— —	470 00	470 00	17
Sept. 30, '07,	Nov. 29, '07,	Nov. 20, '07,	— —	227 00	227 00	18

⁴ Bid did not comply with requirements of specifications.⁵ Competitive bids were not received on this contract.⁶ Bids were upon designs submitted by bidders.⁷ Bids were upon different types of compressors.

CONTRACTS MADE AND PENDING DURING

1.	No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
				4. Next to Lowest.	5. Lowest.	
1	81	Section 6 of the Boston Marginal Conduit and Section 4 of the Boston Embankment.	6	\$74,700 50 ¹	\$69,054 50	William H. Ellis, Boston, Mass.
2	84 ²	Cast-iron pipes and special castings.	1	—	1,528 50 ¹	Camden Iron Works.
3	85 ²	Plug drain valves for the Fens gate-house.	1	—	238 00 ¹	Coldwell-Wilcox Company.
4	86 ²	Twisted steel rods for reinforcing concrete, Boston Marginal Conduit and rest pier.	4	1,053 41	1,051 38 ¹	Aberthaw Construction Company.
5	87 ²	Castings, . . .	4	344 13	261 50 ¹	Barbour Stockwell Company, Cambridge, Mass.
6	88 ²	Manhole frames, ladders, etc., for Section 6 of the Boston Marginal Conduit.	5	672 00	549 00 ¹	New England Bolt & Steel Company, Everett, Mass.
7	89	Spruce lumber for repairing temporary bridge.	4	3,375 00	3,300 00 ¹	William H. Wood & Company.
8	90	Tide-gates for Sections 5 and 6 of the Boston Marginal Conduit.	— ³	— ³	5,490 00 ¹	Gibby Foundry Company, East Boston, Mass.

¹ Contract based upon this bid.² Contract completed.

THE YEAR ENDING NOV. 30, 1908 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1908.	
Jan. 31, '08,	May 1, '09,	—	For coffer-dam at Fens Pond bridge, \$2,500; coffer-dam at gate-chamber, \$3,500; coffer-dam at Boston Marginal Conduit, \$2,500; earth filling, \$0.50, \$0.60 and \$0.96 per cu. yd.; earth excavation, \$2 per cu. yd.; piles, \$0.20 and \$0.25 per lin. ft.; concrete masonry, \$12 and \$15 per cu. yd.; granolithic surfacing, \$8 per sq. yd.; ashlar masonry, \$17.80 and \$34 per cu. yd.; dimension stone masonry, \$30 per cu. yd.; face dressing of pointed work, \$0.70 per sq. ft.; riprap, \$2 per ton of 2,000 lbs.; placing iron and other metal work, \$25 per ton of \$2,000 lbs.; temporary outlet from Stony Brook conduits, \$2,000.	\$78,000 00	\$58,208 93	1
Dec. 7, '07,	Feb. 7, '08,	Apr. 9, '08,	For 60-inch cast-iron pipe, \$26.50 per ton of 2,000 lbs.; 60-inch $\frac{1}{16}$ and 60-inch $\frac{1}{8}$ curves, \$85 per ton of 2,000 lbs.	1,580 76	1,580 76	2
Nov. 4, '07,	Feb. 2, '08,	Jan. 15, '08,	— —	238 00	238 00	3
Nov. 29, '07,	Mar. 1, '08,	Dec. 31, '07,	— —	1,051 43	1,051 43	4
Feb. 18, '08,	May 18, '08,	Mar. 18, '08,	For iron castings, \$0.035 and \$0.025 per lb.	245 92	245 92	5
Feb. 25, '08,	Apr. 25, '08,	May 5, '08,	For the whole work, \$549.	558 50	558 50	6
Feb. 13, '08,	Jan. 1, '09,	—	For 2-inch and 3-inch spruce plank, \$22 per M. ft. B. M.	3,300 00	3,029 98	7
Mar. 9, '08,	Oct. 26, '08,	—	For the whole work, \$5,490.	4,000 00 ⁴	3,000 00	8

³ Competitive bids were not received on this contract.⁴ Reduced by \$1,490 on account of cancellation of part of contract.

CONTRACTS MADE AND PENDING DURING

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.	
			4. Next to Lowest.	5. Lowest.		
1	91 ¹	Oak piles in front of bulkhead of Boston Woven Hose & Rubber Company, in Broad Canal.	- ²	- ²	William L. Miller, Boston, Mass.	
2	92 ¹	Structural steel for the lower lock-gate house.	16	\$4,651 00	\$4,570 00 ³	The Phoenix Iron Company, Philadelphia, Pa.
3	93 ¹	Twisted steel rods for reinforcing concrete, Boston Marginal Conduit.	7	1,009 19	981 88 ³	James W. Sederquist, Boston, Mass.
4	94	Lower lock-gate house,	14	39,400 00	37,300 00 ³	Horton & Hemenway, Boston, Mass.
5	95	Submerged outlets for the Boston Marginal Conduit.	4	58,874 00	42,500 00 ³	Hiram W. Phillips.
6	96	2-inch pump at upper end of Lock.	- ²	- ²	895 00 ³	The Lawrence Machine Company.
7	97	Piping at Lock,	9	2,687 00	2,663 00 ³	The Merrill Company, Boston, Mass.
8	98	Electric wiring for lock-gate houses.	6	790 00	671 00 ³	Barnes-Pope Electric Company, Boston, Mass.
9	99 ¹	Structural steel for upper lock-gate house.	9	1,519 50	1,475 00 ³	American Bridge Company of New York.
10	100	Upper lock-gate house.	12	11,390 00	10,400 00 ³	The Norcross Brothers Company, Boston, Mass.
11	101	Plumbing for lower lock-gate house.	7	1,400 00	1,388 00 ³	Buerkel & Company, Boston, Mass.
12	102	Electric motors for operating sluice-gates, at Fens gate-chamber.	2	1,080 00	575 00 ³	General Electric Company, Boston, Mass.
13	103	Controlling apparatus for sluice-gates at Fens gate-chamber.	2 ⁴	1,025 00 ³	600 00	The Cutler-Hammer Manufacturing Company.
14	104	Sluice-gates for Fens gate-chamber.	4	7,565 00	7,220 00 ³	Chapman Valve Manufacturing Company, Indian Orchard, Mass.
15	105	Part of the Cambridge Marginal Conduit.	3	11,835 50	10,837 00 ³	Coleman Brothers.

¹ Contract completed.² Competitive bids were not received on this contract.³ Contract based upon this bid.

THE YEAR ENDING NOV. 30, 1908 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1908.	
Feb. 26, '08,	—	Apr. 21, '08,	For oak piles in place, \$20 per pile; long leaf yellow pine in place, \$50 per M. ft. B. M.; iron or steel in place, \$0.03 per lb.	\$1,008 77	\$1,008 77	1
Apr. 28, '08,	Aug. 15, '08,	July 20, '08,	For the whole work, \$4,570.	4,570 00	4,570 00	2
Mar. 31, '08,	May 12, '08,	May 6, '08,	For square twisted steel rods, \$1.86, \$1.91 and \$1.96 per hundred lbs.	1,006 71	1,006 71	3
June 4, '08,	Mar. 1, '09,	—	For the whole work, \$37,300.	37,300 00	22,438 14	4
July 10, '08,	Dec. 1, '08,	—	For the whole work, \$42,500.	42,500 00	21,675 00	5
May 23, '08,	—	—	For the whole work, \$895.	895 00	—	6
July 7, '08,	—	—	For the whole work, \$2,663.	2,663 00	1,866 29	7
July 16, '08,	—	—	For the whole work, \$671.	671 00	285 17	8
July 11, '08,	Sept. 15, '08,	Oct. 6, '08,	For the whole work, \$1,475.	1,475 00	1,475 00	9
July 1, '08,	Jan. 1, '09,	—	For the whole work, \$10,400.	10,400 00	3,978 00	10
July 16, '08,	—	—	For the whole work, \$1,388.	1,388 00	821 98	11
July 21, '08,	Sept. 22, '08,	—	For the whole work, \$575.	575 00	—	12
Aug. 8, '08,	Sept. 26, '08,	—	For the whole work, \$1,025.	1,025 00	—	13
Aug. 7, '08,	Nov. 7, '08,	—	For the whole work, \$7,220.	6,920 00 ⁵	—	14
Aug. 19, '08,	Oct. 15, '08,	—	For earth excavation, \$2 per cu. yd.; earth filling, \$0.50 and \$0.75 per cu. yd.; piles, \$0.20 per lin. ft.; concrete masonry, \$12 per cu. yd.; sheeting, \$60 per M. ft. B. M.	10,837 00	5,741 75	15

⁴ Bids were upon different designs.⁵ Reduced by \$300 on account of modification of specifications.

CONTRACTS MADE AND PENDING DURING

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1 106	Wall at wharf of Bay State Fuel Company on Broad Canal.	3	\$18,711 00	\$17,985 00 ¹	William L. Miller.
2 107	Traveling cranes for lock-gate houses.	- ²	- ²	1,400 00	The Brown Hoisting Machinery Company, Cleveland, Ohio.
3 108	Hardware for lock-gate houses.	2 ³	749 00 ¹	688 00	Bay State Hardware Company, Boston, Mass.
4 109	Switchboard for operating room at Lock.	2	655 00	584 00 ¹	General Electric Company.
5 110	Piping at sluices.	5	784 00	745 00 ¹	Walworth Construction & Supply Company, Boston, Mass.
6 111	Sidewalk lights at lower lock-gate house.	- ²	- ²	1,019 00 ¹	American Luxfer Prism Company of Illinois.
7 112	Submerged intake for the salt water sluice at the sluices.	3	12,500 00	4,884 00 ¹	William H. Ellis.
8 113	Anthracite coal for boiler plant at Lock.	4	1,150 00 ⁴	1,148 00 ^{1,4}	Consumers' Coal Corporation, Boston, Mass.
9 Special Order. ⁵	Erection of lock-gate operating machinery.	- ²	- ²	- ²	The Lockwood Manufacturing Company.
10 Special Order. ⁵	Painting structural steel work at Lock and sluices.	- ²	- ²	- ²	A. G. Danielson, Roxbury, Mass.
11 Special Order. ⁵	Electric wiring at sluices.	- ²	- ²	- ²	Barnes Electric Company, Boston, Mass.
12 Special Order. ⁵	Wiring at Lock.	- ²	- ²	- ²	Barnes Electric Company.
13 Special Order. ⁵	Lubricating system for lock-gate trucks, and placing plates and gaskets over radiator recesses at Lock.	- ²	- ²	- ²	The Lumsden & Van Stone Company.

¹ Contract based upon this bid.² Competitive bids were not received on this contract.³ Bids were upon different grades of hardware.

THE YEAR ENDING NOV. 30, 1908—*Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1908.	
Sept. 24, '08,	Nov. 23, '08,	—	For removing exist- ing wall and oak piling and rebuild- ing wall and re- driving piling, \$54.50 per lin. ft. of wall built.	\$17,985 00	\$15,055 62	1
Oct. 5, '08,	—	—	For the whole work, \$1,400.	1,400 00	—	2
Oct. 2, '08,	—	—	For the whole work, \$749. ⁴	749 00	—	3
Oct. 23, '08,	Dec. 11, '08,	—	For the whole work, \$584.	584 00	—	4
Oct. 27, '08,	Nov. 16, '08,	—	For the whole work, \$745.	745 00	—	5
Oct. 19, '08,	Nov. 20, '08,	—	For the whole work, \$1,019.	1,019 00	—	6
Nov. 28, '08,	Mar. 15, '09,	—	For the whole work, \$4,884.	4,884 00	—	7
Nov. 27, '08,	—	—	For anthracite coal, \$5.74 per ton, based on a per- centage of ash of 4.68.	1,148 00	—	8
Jan. 8, '08,	—	Mar. 19, '08,	For machinists and helpers, \$4 per day each.	530 ¹ / ₂ 15	530 15	9
Jan. 9, '08,	—	Aug. 14, ⁵ '08,	For painters, \$0.48 per hour each, in- cluding tools.	1,826 88	1,826 88	10
Jan. 10, '08,	—	Apr. 16, '08,	For electricians, \$0.70 per hour; helpers, \$0.50 per hour; material, cost plus 10 per cent.	891 11	891 11	11
Jan. 14, '08,	—	Apr. 16, '08,	For electricians, \$0.70 per hour; helpers, \$0.50 per hour; material, cost plus 10 per cent.	748 93	748 93	12
Feb. 15, '08,	—	Apr. '30, '08,	For two men, \$8 per day; brass pipe, \$0.21 and \$0.22 per lb.; brass fittings, 70 per cent. dis- count from list; cast-iron fittings, 65 per cent. and 10 per cent. discount; plain pipe, \$0.021 and \$0.037 per ft.	954 84	954 84	13

⁴ Subject to correction for variations of ash from the standard established by bidder.⁵ Contract completed.

CONTRACTS MADE AND PENDING DURING

1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID.		6. Contractor.
			4. Next to Lowest.	5. Lowest.	
1 Special Order. ¹	Erection of lock-gate operating chain supports.	- ²	- ²	- ²	The Lockwood Manufacturing Company.
2 Special Order. ¹	Overhead wiring for lights at Lock.	- ²	- ²	- ²	Barnes Electric Company.
3 Special Order. ¹	Cable for supplying arc lights at Lock.	- ²	- ²	- ²	The Edison Electric Illuminating Company of Boston, Boston, Mass.
4 Special Order. ¹	Towboat service, assisting navigation through the Dam.	- ²	- ²	- ²	The Commercial Towboat Company, Boston, Mass.
5 Special Order.	Oak piles, . . .	- ²	- ²	\$537 50 ³	W. A. Sherburne, Boston, Mass.
6 Special Order.	Electrical work at Lock.	- ²	- ²	- ²	Barnes-Pope Electric Company.
	Totals, . . .	. . .	. . .	. . .	. . .

¹ Contract completed.² Competitive bids were not received on this contract.

THE YEAR ENDING NOV. 30, 1908 — *Concluded.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Nov. 30, 1908.	
Mar. 17, '08,	—	Apr. 23, '08,	For machinists and helpers, \$4 per day each.	\$660 34	\$660 34	1
May 29, '08,	—	Oct. 31, '08,	For electricians, \$0.70 per hour; helpers, \$0.50 per hour; material, cost plus 10 per cent.	927 85	927 85	2
June 30, '08,	—	July 20, '08,	— —	575 00	575 00	3
Aug. 7, '08,	—	Nov. 2, '08,	For continuous 24- hour service, \$55 per day.	3,905 00	3,905 00	4
Oct. 15, '08,	Nov. 6, '08,	—	For prime oak piles, \$10.75 per pile.	537 50	290 25	5
Nov. 16, '08,	—	—	For electricians, \$0.65 per hour; helpers, \$0.35 per hour; materials, cost plus 10 per cent.	—	—	6
.	\$2,247,744 16	\$1,773,113 79	

³ Contract based upon this bid.

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